Darkroom chemicals

Buying chemicals to mix your own processing solutions is a useful alternative to ready made materials. Here are a few guidelines on how to go about it

Dave King/chemicals courtesy of Speedibrews

Storage *Your chemicals and measuring equipment should be neatly stored. Give plenty of shelf space to bottles, and keep the working surface clean and tidy*

Although retail processing packs are convenient and save time, there is something to be said for buying your own basic ingredients and mixing your solutions from them. This can not only save money in the long term, it also allows you to adjust solutions to suit processing conditions. Furthermore, retail processing packs deteriorate if stored for long periods, whereas most unmixed ingredients do not.

Many darkroom enthusiasts are wary of mixing their own chemicals, partly because they think a high degree of accuracy is required. In fact, absolute accuracy is not essential—small errors make little difference, and you may want to vary proportions to achieve a given effect. The formulae for the majority of processing solutions are widely published in books and magazines, so preparation should present no problem. Indeed, where some of the less widely available solutions are required, mixing them yourself is often the only way of obtaining them regularly.

Solids, liquids and solutions

Almost all the common photochemicals occur as solids, either as powders or crystals. Most powders are finely ground crystals, so it makes no difference which you buy—powders usually dissolve more quickly. A few liquids may be required, especially for colour processing. Tap water is perfectly suitable for mixing the majority of solutions.

Some sodium compounds are available in two solid forms—crystals or anhydrous powder. Sodium sulphite, sodium carbonate and sodium thiosulphate all come in these two forms. In the anhydrous form, the chemically bound water in the crystals has evaporated, allowing the compound to crumble into a dry powder. The anhydrous form keeps better, except for sodium thiosulphate which is stable in both forms. Whichever form you buy, bear in mind that each must be measured out in a different weight—up to 50% error is possible if you use the wrong weight with the wrong form. Never use crystals which have partially crumbled, because there is no way of telling how much to use when mixing.

Some chemicals behave in the opposite way, and absorb large amounts of moisture from the air. They are labelled 'hygroscopic' or 'deliquescent'. It can be difficult to measure them out without them sticking to utensils or receptacles. In these cases it is best to weigh out a reasonable amount, make a stock solution from it and pour it out as required.

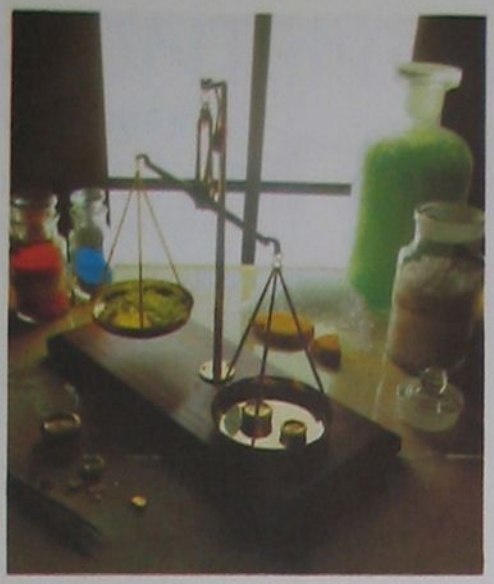
Chemicals which are only used in very small amounts at a time, such as antifogging agents, are best bought as a dilute bulk solution, and then dispensed as required. Other chemicals are only stable as solutions, and only available in that form—formaldehyde and ammonia are typical examples, and can be bought in different concentrations. You may also need chemicals in liquid form for colour work, either as solvents or to improve chemical penetration into the film base. Processing formulae give full details on how to use these.

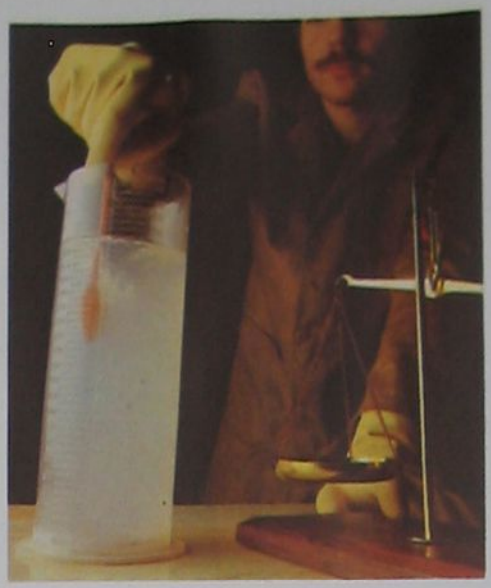
One chemical is usually liquid but its name refers to its frozen form. Glacial acetic acid, used in stop baths, freezes into glistening crystals at low temperatures. Even a small amount of water stops it freezing, so it is purest in its frozen 'glacial' form. However, it is not always convenient to store frozen chemicals, so 28 per cent and 3 per cent dilutions are often used, and are quite adequate.

Where to buy chemicals

Unmixed chemicals are not always readily available from photographic dealers, and many shops will not order them. If you cannot obtain what you need from your regular dealer, you must be prepared to try other sources. These sources include pharmacists, chemical retailers and the chemical manufacturers themselves.

Pharmacists are often, incorrectly, called 'chemists' or 'dispensing chemists' in the English speaking world outside North America. They can, however, obtain chemicals and may even have a





Weighing and mixing *It is important to weigh your chemicals accurately if you want the best possible results. Once weighed, they should be thoroughly mixed in a measuring cylinder. Liquid concentrates can be measured out with a pipette*

Dave King/chemicals courtesy of Speedibrews

limited range in stock. So if you find a pharmacist who is willing to help, he will probably be able to satisfy your needs. He may be reluctant, though, to let you have the more dangerous chemicals until he knows you. Once you have persuaded him to go through his catalogue and sell retail, write a list of what you need, leaving the quantities blank—it is worth spending a little more to facilitate the pharmacist's task.

One place to start looking is in the telephone directory—look under 'photo', and if this brings no results, try 'chemicals' or 'chemical suppliers'. Many of these may be prepared to sell their products retail. If this brings no results, try to get in touch with stockists. One way to do this is to contact your local secondary school, technical college or university. Their purchasing department usually know the best sources of chemicals and regularly buy from them. Once you have proved a bona fide reason for buying the chemicals, they may well prove very helpful.

Before placing a first order through a retailer it is wise to telephone and check on any restrictions or order limits—if the company is not helpful, move on to another—there are plenty of sources to choose from.

If you do not succeed in finding a retail outlet, try ordering direct as a last resort. Apart from Eastman Kodak, companies such as BDH Chemicals Ltd or Merck have offices in most countries—both have specialized photochemical ranges. They may well be reluctant to supply small orders, and could ask the serious buyer to open some sort of account. Therefore, if you cannot obtain your chemicals through a retailer source you must be prepared to order quantities at least of the minimum order size stipulated by the supplier.

One possible arrangement is known as a 'Proforma Invoice'. To obtain this you must send a list of the products to the supplier together with a request for a proforma invoice. This will be sent back to you with the prices and conditions of sale. The advantage of this system is that it demonstrates more than a casual interest on your part. Although the invoice does not commit you to anything, it inspires confidence. You can always suit your order to your requirements or to the availability and cost of chemicals.

Some firms may even allow you to make telephone enquiries—in these cases, you can check all the prices and conditions before the proforma invoice is sent to you. Whatever the arrangement with your suppliers, always pay by the agreed time limit—it will be appreciated.

How much to buy

It is a good idea not to buy too much at first. Many of the small packs contain enough to process a large number of prints or films. Until you know what you need to use and in what proportions, it is a false economy to buy too much. Also, if you cannot achieve good results with the combination of chemicals you have bought, the wastage will be cut to a minimum.

Once a satisfactory formula has been found, you can then begin to order chemicals in the correct proportions. Since a considerable part of the cost of these chemicals is packaging and handling, you save a great deal in the long run by buying in bulk, especially when some of the chemicals are used in more than one formula. In the case of chemicals which fluctuate in price, buying in bulk can make a further saving—as long as you buy when the price is low. So once you have established your requirements, and if you have sufficient storage space, never hesitate to buy in bulk. Use the supplier's containers as far as possible, but if you cannot, make sure that labelling is clear on all your own containers. The more details you include, the less likely you are to make mistakes.

When your chemicals are bought from specialist photochemical suppliers, they will be sold in conveniently sized packs for amateur use—usually enough for about ten litres. Expensive substances or those used in small quantities, are generally sold in 10 g or 25 g packs. Most other substances can be bought in 100 g, 250 g and 500 g sizes or larger. When you are buying your first batch, it is unlikely that you will need more than one kilo of anything.

When you buy from a dealer who is not a specialized photochemical dealer, you may not be able to buy in small quantities—often, the smallest pack sizes are determined by the major customers, and are quite large. In these cases, the best you can do is simply to buy the smallest quantity they offer.

Sales restrictions

You can buy any photographic chemical in wide use from a photographic dealer—although some chemicals are

Labelling *Bottles containing chemicals should be clearly labelled—there must be no room for error. Glass bottles are more suitable than plastic types*

dangerous, there are surprisingly few restrictions on sales. Laws and restrictions vary from country to country, but your chances of obtaining controlled chemicals are much better if you are known to your dealer as a sensible user.

In the case of chemicals regarded as poisons, there may be a certain amount of paperwork involved—here, too, your position is easier if you are known to the dealer. Sometimes, too, there may be an alternative, non-toxic chemical freely available. A good dealer should be able to advise you on alternatives where sale restrictions are a problem.

Cost of chemicals

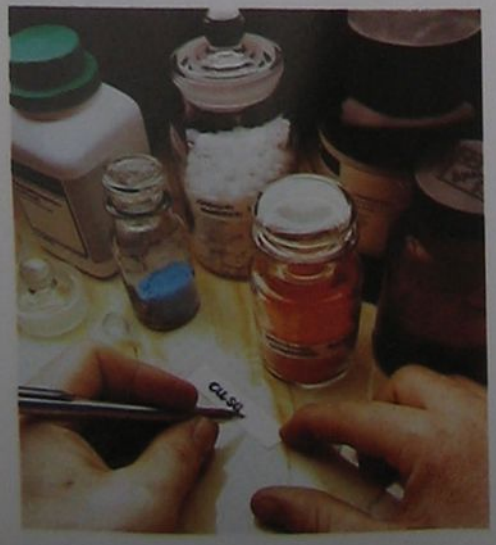
Prices of chemicals vary, but as a general rule those used for monochrome work are roughly the same price. So, to work out what your total outlay is likely to be, take a stock component, like sodium sulphite, and multiply the price by the total quantity of components you intend to buy.

This does not apply to colour processing chemicals, which vary greatly in price. It is a good idea to shop around—you may find lower prices with a particular dealer. Remember, though, that a lower price on one chemical may well be cancelled out by a higher one on another, so the price of a complete range may not vary all that much.

Chemicals for new processes or special techniques may be fairly costly—some may have a single supply source or be controlled by patents. Expect to pay a high price for anything with a long chemical name. However, even at normal retail prices, you should make considerable savings compared to ready mixed solutions. Standard powders like D-76 can be anything between a half and a fifth of the cost, while ready made concentrates like those used in colour processing can cost a tenth of the price if you mix your own.

Storage and handling

It is essential that you store your chemicals correctly, both for safety and for efficiency in the darkroom. Use glass bottles in preference to plastic ones if possible. This is because plastic can pick up a static electricity charge, which may cause a powder to fly out of the bottle when it is opened. Not only can this cause difficulties in the darkroom, but it might lead to contamination and a health hazard in the house. Furthermore, glass keeps its contents better than plastic.



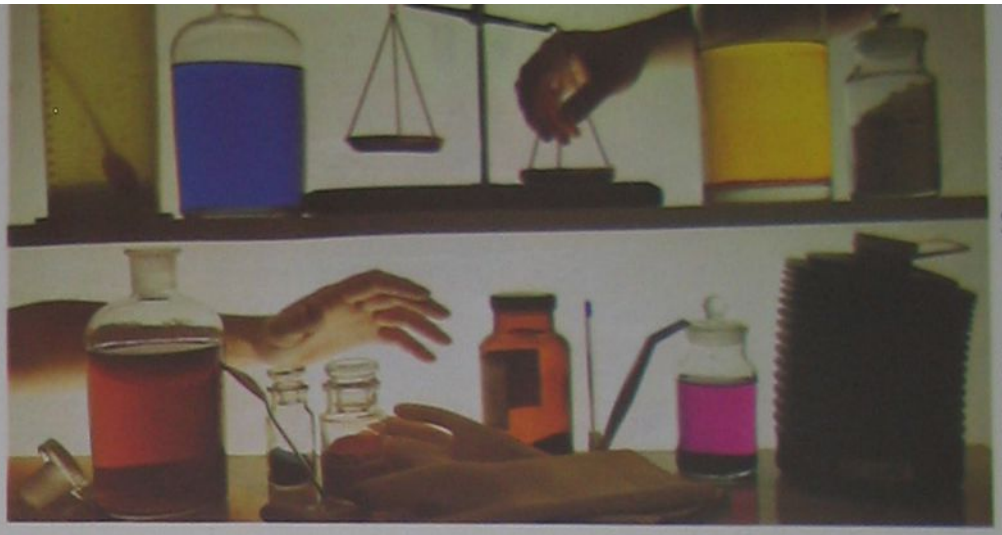
If handled carelessly in the darkroom, many chemicals can lead to fogging of films or papers. So take particular care if you handle chemicals near to film or paper. A little developer goes a long way, and a few drops might ruin a batch of paper. The best way to avoid these problems is to always work slowly and methodically when handling chemicals.

Make sure you label all your containers properly. All relevant information should be clearly written in indelible ink. Details of strength of dilution, date, and so on are especially relevant. Coloured self-adhesive labels can be used as a code, allowing you to identify chemicals quickly and easily.

Safety

All chemicals are potentially dangerous, if handled carelessly or used in the wrong context. While experimentation is an integral part of darkroom work, it is dangerous to mix chemicals randomly: only mix chemicals if you are absolutely certain of the outcome. For example, while sodium metabisulphite is often used in acid fixing baths, if you simply add the metabisulphite to an acid, choking sulphur dioxide fumes will be given off. Even apparently harmless chemicals can be dangerous in the wrong combination—adding sugar to permanganate bleach, for instance, results in a highly explosive mixture. If you have any doubt about a combination, ask a qualified chemist, and always follow these basic rules for safe handling of darkroom chemicals.

- **Never ingest anything** You can eliminate this risk by never eating, drinking or smoking while handling chemicals. Some people are in the habit of licking a finger before turning a page—never do this.
- **Avoid contact with the eyes** Do not touch your eyes while handling chemicals.
- **Always wear rubber gloves when handling chemicals** Wash them when you have finished.
- **Store chemicals properly** Never use food containers—chemicals might be mistaken for the original contents.
- **Label correctly** Label clearly in indelible ink on self-adhesive labels.
- **Do not inhale fumes** Certain chemicals, such as sulphide toners or mercury from a broken thermometer, are toxic and dangerous in a confined space. Make sure you know which chemicals have this property.



Dave King/chemicals courtesy of Speedibrews

Chemist's nightmare *Though the crystals shown here are all distinctive, many are simply white powders, so never allow them to intermingle*

Special problems

Some of the more dangerous chemicals are identified by a yellow label, which indicates a special hazard. Exercise special care when you are handling one of these.

- **Metol** This is known chemically as 4-methylamino phenol sulphate. The name is usually seen in its older form, with 'para' instea of 4 (see page 1605). With continued use, this may cause allergies in certain people. Use rubber gloves and wash it off as soon as possible. Better still, use an alternative formula which employs phenidone, wherever this is possible.
- **Colour developing agents** There are many of these, and they are all, like metol, potentially dangerous. Most are in a fine powder form, and can be easily blown about. Here too, exercise special care when handling.
- **Formaldehyde** Otherwise known as formalin, this is still used to preserve dead animal specimens. It is corrosive, and kills living cells. Prevent the vapours from getting in your eyes, and do not inhale them—only use in a ventilated room.
- **Silver nitrate** Also highly corrosive—it is used for removing warts. It makes an indelible stain on anything it touches.
- **Unknown chemicals** Any chemical whose properties you do not know must be treated as an unknown quantity—toners and bleachers are an example. Some of the Cibachrome processing solutions can also be dangerous in large quantities. If you have any doubt about a chemical, make sure you find out from your supplier what its properties are—it is better to be safe than sorry.

Douglas Kirkland

A Canadian photographer who gained fame in America, Kirkland made his reputation photographing some of the world's most beautiful women. Now he is equally at home photographing scientists

Douglas Kirkland/Contact/Colorific

At 21 when he was still a young photographer working on his local newspaper in Canada, Douglas Kirkland drove down to California. He remembers driving past the Brooks Institute of Photography at Santa Barbara, and realizing that he had no chance of ever studying there. It seemed a glamorous unattainable goal, beyond his financial reach. In 1975, exactly 20 years to the week later, he found himself on the same road again. Only this time he was actually going to the school—as a guest speaker to give a lecture on photography.

As a top photographer Kirkland is known internationally, particularly for his stunning and sensual portraits of some of the world's most beautiful women—such as Monroe, Bardot, Dietrich, and Brooke Shields.

Kirkland built his reputation during the so-called 'Swinging 60s'. This was still the era of the great American picture weeklies—*Look* and *Life*, and the time when photography was one of the most glamorous professions to be in. Working for these magazines, Kirkland spent the 60s and 70s commuting between New York, Paris and London.

Nowadays Kirkland's assignments not only take him all over the world but also into an extraordinary variety of individual worlds. He might be shooting at a movie star's Malibu Beach house one day, on the plane to photograph an astronomical event in Chile the next, and then travelling to some remote place to photograph the location shooting of a major feature film—stuff that dreams are made of.

But to attain such an enviable position and lifestyle, Douglas Kirkland has had to work hard, displaying above all, a consistent professionalism and the ability to produce good results.

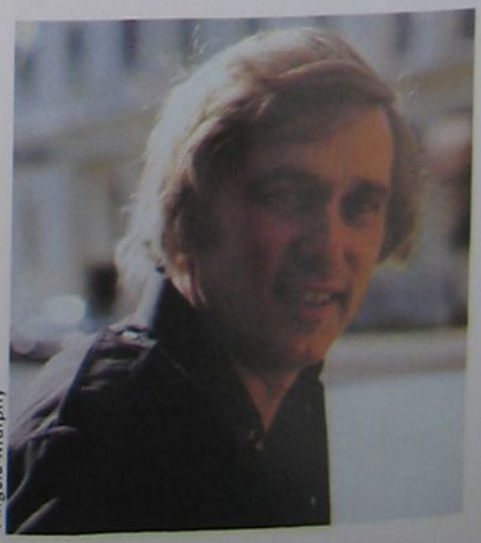
He displayed a remarkable single-mindedness from the moment he started out. By his late teens he was working part-time in local photographic studios having discovered the fascination of photography. 'My whole Walter Mitty fantasy period was spent developing pictures. It was my secret world and the only thing that I seemed to be able to do that other people couldn't.'

After he left school, Kirkland spent three years taking photographs for local newspapers but realized that his ambitions could only be attained in the United States, where his perseverance eventually got him several assistant jobs in New York.

A few years later in 1959 Kirkland raised a $700 loan and set up on his own. 'I succeeded pretty much because I would set out with samples of my photographs and pound away. I considered my job was to sell myself—the fun of it came when I had the chance to take pictures. I would take pictures for small trade magazines and corporations—everything they could give me. Then at the end of 1959, after about five or six months, *Look* magazine called me.'

Kirkland's years with *Look*—at first as a freelance, and then staff photo-

Katharine Hepburn (*left*) *Shot with a 180 mm lens. 1/1000 second at f/4*
Douglas Kirkland (*below*) *photographer*



Angela Murphy

Brigitte Bardot *Taken during a long assignment for 'Look' magazine, Mexico, 1964. 28 mm lens using high speed film*

Marlene Dietrich *New York, 1964. One of Kirkland's favourite portriats, this legendary actress was shot for 'Look'*

Douglas Kirkland/Contact/Colorific

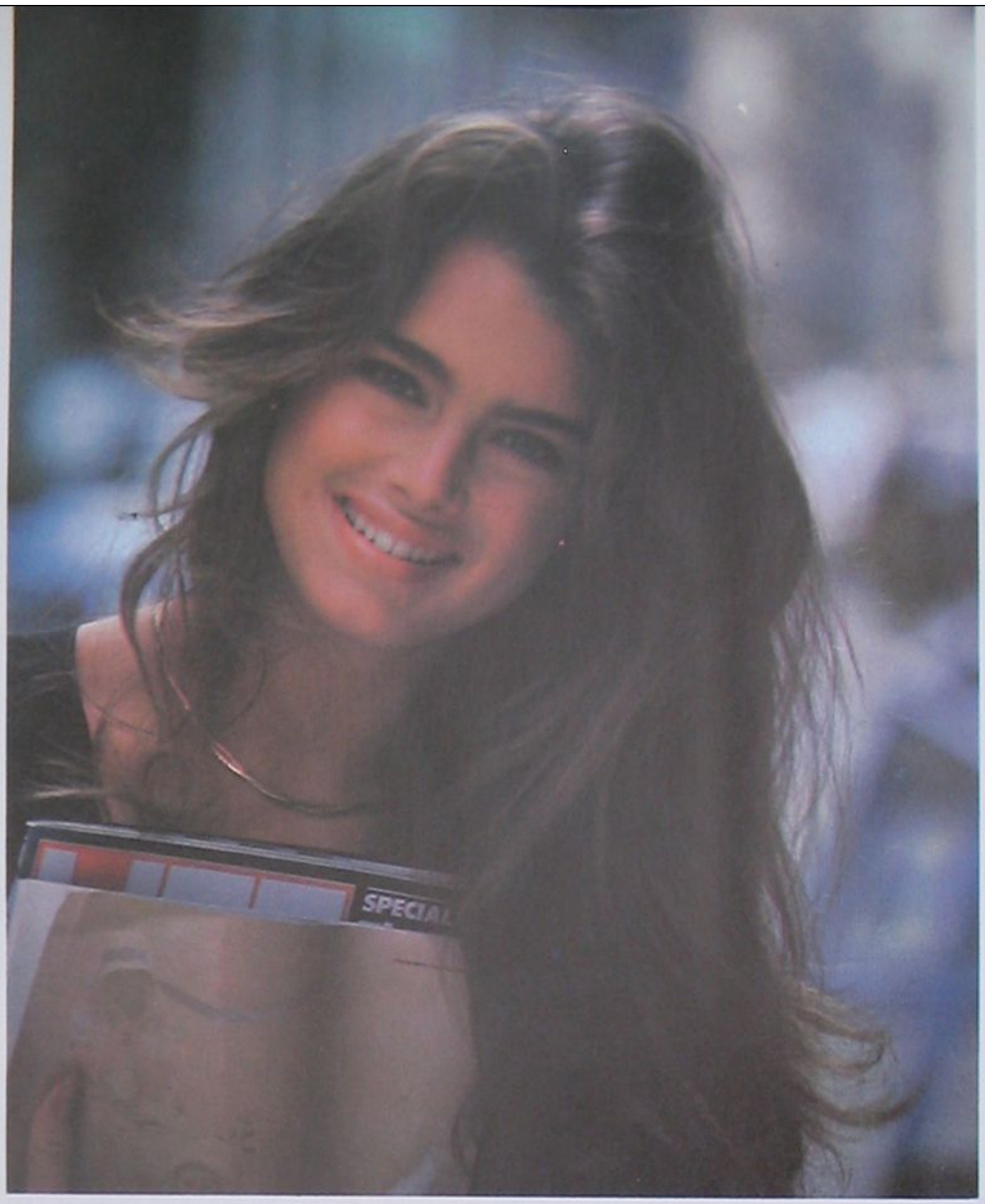
grapher, and later on under contract—were the making of him as a professional. 'About a year and a half after I joined *Look*, I suddenly felt as if a huge light bulb had gone on in my head. It was like an awakening. Suddenly I could do things I couldn't do before.

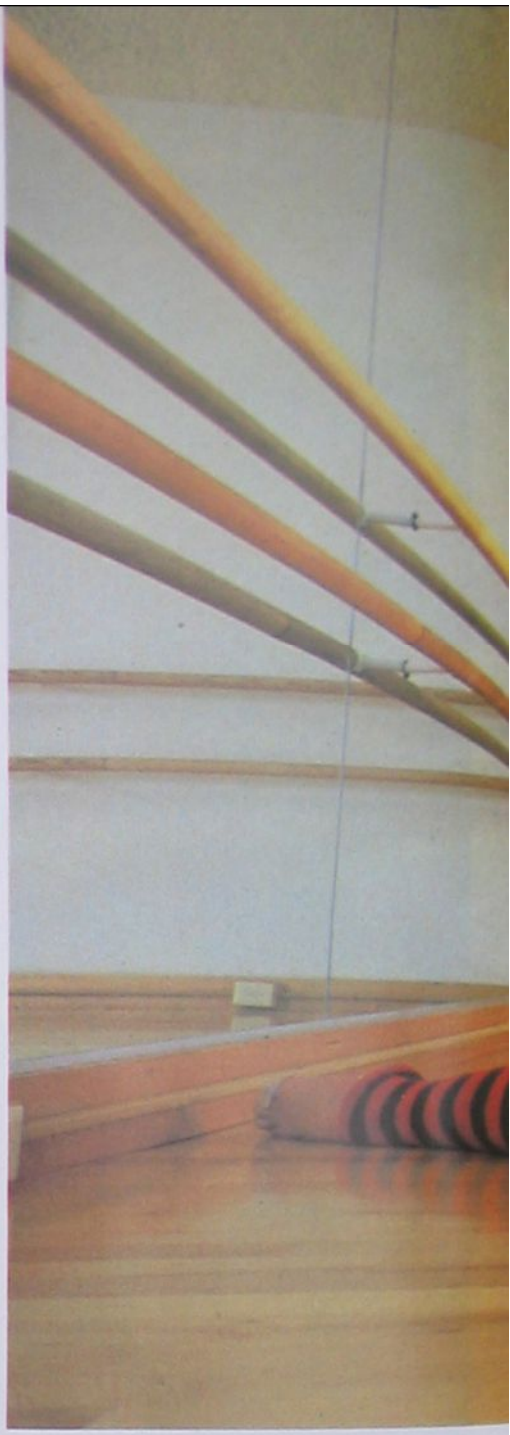
'*Look* magazine catapulted me into all sorts of situations and brought me to Europe a great deal. Being in London and France and Italy and meeting new people, it would be hard not to have an awakening. My photography was always more advanced than my personality.'

In 1963, Kirkland swapped the security of a staff job to go on contract to the magazine. 'I felt I was repeating things and decided to take a chance and work for a lot of different people. It was very good. It was the golden age of photography and I didn't seem to be able to stop visiting new places and working for new people.

'I spent a lot of time on film sets and a lot of time in London. People in the States were very interested in what was going on in London in the 60s. I spent time doing all types of stories from Biba's boutique to Julie Christie and John Lennon. I was meeting all kinds of people and generally staying at the Dorchester with all my buddies.

'It was a high life. We seemed to have





Douglas Kirkland/Contact/Colorific

Jane Fonda (*above*) *Part of a photo-essay for Harper's Bazaar, Los Angeles, 1979. Reflected strobes. 43-86 mm zoom*

Brooke Shields (*top left*) *Kirkland used a 75-200 mm zoom and shot on 1/60 second at f/4. A world-wide cover story, 1981*

Cher (*left*), *the singer and entertainer. Shot at Venice Beach with a Hasselblad ELM, 1/500 second at f/8*

everything. I made a lot of money and, with my kind of work, I had unlimited expense accounts. For Americans in London, money seemed to last forever. I remember once staying in the Dorchester for a month and a half, just doing one story after another. It was never even questioned by my employers.'

Riding high on a crest of popularity, Kirkland worked for almost every leading magazine—*McCalls*, *Paris Match*, the London *Sunday Times*. By the mid 60s he was separated from his first wife—with whom he had three children—and had married again, this time to Francoise, a French woman that he met in Paris.

Life had changed dramatically for a photographer who started his career with an almost total ignorance of European culture. Travelling in Europe his work gradually acquired an exciting new sophistication.

In his early 30s, he was still working mainly for *Look* but in 1971 *Look* magazine stopped publication, unable to sustain the rapid drop in advertising that all magazines were suffering. Its demise was a heavy blow to many photographers who suddenly saw a sizeable part of their income vanish overnight.

For Douglas Kirkland, though, this was merely the beginning of another successful liaison—this time with *Look's* sister magazine *Life* until it also closed in 1972.

'When any publication goes out of business there are always rumours. You try to dismiss them out of loyalty to the company but you still wonder about it. Then suddenly you go in one morning and they say, "It's all over!". You feel like a disowned child—as if all your loyalty has been thrown away. Most photographers experience this kind of thing from time to time.

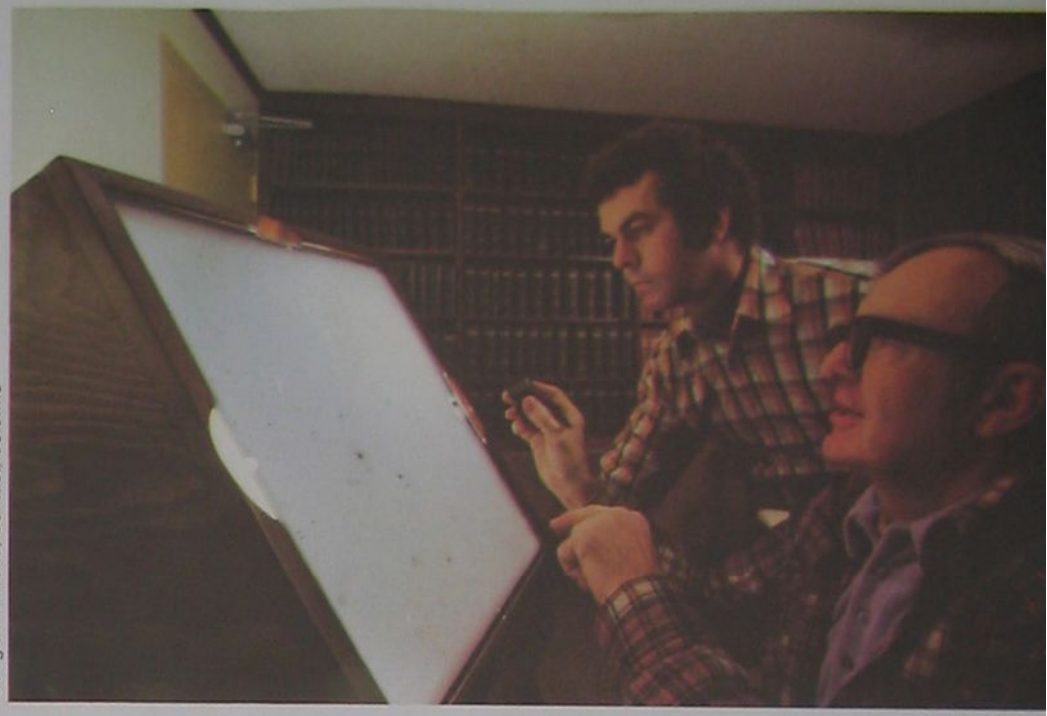
'*Life* and *Look* magazines were like a club, an old boys' club. You'd go there and see all your friends. Nowadays picture agencies have replaced magazines in this respect.'

This aspect of a photographer's life can be very important. Photography is essentially a lonely profession unless you happen to be a successful studio photographer with a large staff. For many photographers, particularly photojournalists, the agencies and cooperatives that have arisen in the tradition of Magnum (see page 112) provide an important emotional service as well as the more obvious commercial benefits.

Kirkland has found that, after a lifetime working for magazines, his involvement

Las Campanas, Chile *This 8½ hour exposure shows the South Celestial Pole. As the earth turned the stars trailed*

Allan Sandage, *astronomer, checks one of the observatory's photographic plates for specific galaxies*



Douglas Kirkland/Contact/Colorific

in the *Contact* agency in New York has given his photography and his life some new directions. Primarily, it gives him an efficient distribution network for his photoessays. But it has also prompted him to branch out into photojournalism occasionally and to increase the amount of time he spends photographing science. As a partner in the agency he also appreciates working with the agency's director, Robert Pledge.

One of the most remarkable aspects of Kirkland's photographic career has been his ability to cover such a wide range and for him, this is the 'joy of photography.' But he is still best known for his glamour portraits of movie stars.

Kirkland laments the changes in glamour photography. Nowadays few magazines can afford to keep a photographer on a story for long. But in the 1960s, Kirkland would frequently spend weeks on tour with such subjects as Judy Garland, Romy Schneider and Brigitte Bardot. These early portraits often display an intimacy that would have been impossible in just a few hours.

Kirkland's professionalism and preparation can pay dividends when time starts to run short. He was once asked by *Harper's Bazaar* to photograph Jane Fonda at the opening of her Beverley Hills gymnasium 'The Workout' and was told that he only had 45 minutes. Fortunately, Kirkland had a very clear idea of what he wanted to do and how to get the best from his subjects. 'If you tell professional people like Jane precisely what you want, they're more comfortable. It's no good telling someone, "Just be natural," when there's a camera about. With actors especially, it's better to direct positively because they're used to being directed—they respect this way of working.' After finishing the *Harper's Bazaar* photoessay, he moved very quickly and did a series of portraits for possible covers—using different backdrops so they could be submitted to a number of magazines.

This particular shoot provides a good illustration of the way Kirkland markets his work. He has a shrewd appraisal of the business side of his work and is always aware of the variety of possible markets for every story he shoots.

'I would treat a story going to Germany in a completely different way from that going to the UK or for the States. So I will always shoot a subject in a number of different ways with this in mind. The only way an editorial photographer can survive today is by being very, very conscious of world markets.'

The movie industry and its stars still form a major part of Douglas Kirkland's work. Living in Los Angeles he is at the heart of the movie industry, but he is now more inclined to cover a variety of other subjects, especially science.

'The world of the actor and actress is somewhat frivolous. Although its glamour attracts me, I felt I needed a counterbalance in the real world. And what could be more meaningful and serious than science today? Also the science publications are expanding rapidly and I generally like the kind of people who are scientists.

'So it's a combination of need and interest. It's a wonderful opportunity for me to learn. I get the chance to meet the greatest astronomers, biologists, nuclear-physicists—all because I'm there. And I have the identification of a company or corporation with me. Usually I'm given the text of the article and I feel I am an illustrator trying to make these things interesting to the public. I'm a medium between science and my audience.'

Kirkland's interest in science is paralleled by his love of the technical aspects of photography. While some photographers prefer to use the absolute minimum of equipment, Kirkland enjoys having a wider choice. He has an extraordinary range of cameras, lenses, and accessories. For his seven Nikon FE camera bodies he owns the whole range of fixed focal length lenses from 12 mm to 500 mm. He also has two Nikkor multipliers, three zoom lenses and a couple of micro lenses.

In addition, Kirkland owns three electric ELM Hasselblads and a range of lenses from 40 to 250 mm and a 10 × 8 Deardorff for special assignments.

His range of lighting equipment is equally extensive. He owns six 800 watt per second Dynalite strobe units with Balcar heads so that there are always some in reserve—if one fails on location he will always have some ready as back-up. The Dynalites are both inexpensive and lightweight and they produce as much light as the more powerful Balcar 1200. The strobes are operated by radio sync devices attached to the hotshoe of each camera and the bottom of his Minolta III strobe meter—he just has to press a button.

He does not see any major advantages to using Hasselblad. 'The only real advantage of the 6 × 6 to me is that it has a between the lens shutter so you can shoot strobe outdoors at any speed. One reason I prefer the FE over almost any other 35 mm camera is that it shoots strobe at 1/125th. When you often use strobe outdoors, as I do, it's a considerable advantage.'

Working out of Los Angeles with frequent visits to New York seems to provide Kirkland with the best of both worlds, and he adapts easily to either. California is an ideal place to produce stories. It is the centre of the movie industry, and is increasingly a major centre for the electronics industry. As he says, 'There's an unlimited amount of work for photographers or writers if they can be plugged into their outlets properly—and that's what *Contact* has done for me. The film business alone has so much that can be tapped out of it.'

Kirkland's success as a photographer has given him the freedom to do the stories that he most enjoys. His commercial acumen also keeps his income in the top bracket. But he is determined not to become a slave to success or to take his exciting and glamorous life for granted.

'I think I'm a member of a very limited but fortunate group of people. It can be very tough if you're trying to work your way up in photography. But when you get to a certain strata in this world you can do almost anything. At this stage in my life if I wanted to spend time with almost anyone in the world, or go anywhere I could probably find a way of doing it. Things are very good for me today. I know I'm a very lucky guy.'

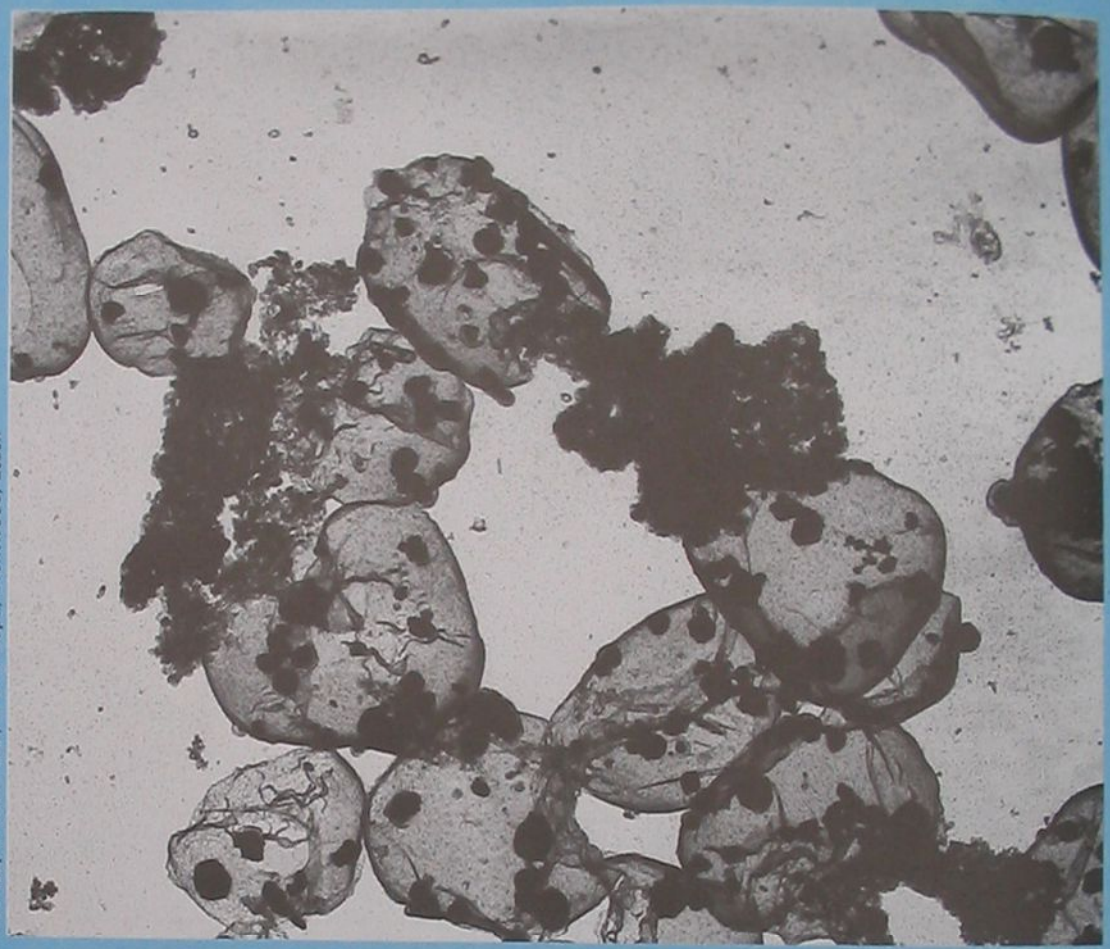
The latent image

Invisible, seemingly insignificant . . . the latent image which forms in the camera consists of virtually undetectable silver specks. Modern photography is only possible because of the action of the developer

In the early days of photography the blackening of the photographic plate was often produced during the exposure and no development was given. But this resulted in very long exposure times and it was soon found that much shorter exposures could be used to form an invisible—or *latent*—image which could then be made visible by suitable chemical processing.

If you could look at a film that has been exposed in a camera but left unprocessed, you would not be able to see any sign of an image. Even under a microscope a silver halide emulsion that has been exposed briefly to light does not reveal the fact. The image is only revealed when the silver halide is reduced to black metallic silver by the action of a developer.

The precise nature of the latent image has been the subject of much debate over the years. But there is very good evidence that the latent image, like the processed image, consists of metallic silver, though in such minute quantities that it cannot be detected by normal chemical or physical means.



Courtesy of Ilford Ltd., R & D Dept., Brentwood, Essex

Halide crystals *magnified 18,000 times, undergoing development. Each shows several latent image centres*

The Gurney-Mott theory

The most widely accepted theory about the latent image was propounded by Gurney and Mott in 1938. And although this theory is not always accepted in its entirety, it gives a logical explanation to most of the observed phenomena.

The basis of the theory is that light falling on the silver halide crystals in the emulsion causes the formation of silver atoms which then act as centres for development. To understand exactly how this happens it is necessary to look at the nature of an emulsion, and this can be done by looking at just one of the many millions of halide crystals.

The theory centres around minute particles—parts of atoms—called *electrons*, which have a negative electrical charge. Silver bromide —a typical halide—is made up of two basic elements in the form of *silver ions* (silver atoms which have lost electrons and so are positively charged) and *bromide ions* (bromine atoms which have gained electrons and so are negatively charged).

When light strikes the halide crystal some of the bromide ions revert to atoms by giving up the extra electrons, which then travel through the crystal. The number of bromide ions which do this depends on the amount of light which reaches the crystal. Eventually the electrons either recombine with the bromine atoms or become trapped at particular points in the crystal. The bromine atoms which are left diffuse to the surface of the crystal and are usually absorbed by the gelatin.

The trapped electrons create a negative electrical charge which attracts some of the silver ions, which then move to the electron trap. Here they combine with the electrons to form atoms of metallic silver. The silver acts as a larger trap for more silver ions, and so on. The degree to which this happens depends largely on the level of exposure—the intensity of the light and exposure time—and the nature of the emulsion.

The latter is especially relevant as far as the electron traps are concerned. There are two main types—defects in the crystal which lead to an *interior* latent image, and sensitivity specks on the surface of the crystal giving an *exterior* latent image. The specks are the result of sulphur impurities in the gelatin, and in modern films these impurities are deliberately added. Originally, however, the inclusion of sulphur was accidental. It came from the mustard which cows ate (the hides and hooves of the cows are used to make the gelatin). If the sensitivity specks were not present the films would be much less sensitive as there would be fewer electron traps. Indeed, Dr C. E. K. Mees once observed 'If cows didn't like mustard we couldn't go to the movies'.

Developing the image

The silver atoms forming the latent image provide the basic structure which developers act on to give the final visible image. There are, in fact, two types of development, depending on

Robert Sleigh

Printing out *Bromide paper will darken in the light as the latent images strengthen. You can make photograms in this way using a contact frame. The results are attractive but short lived unless fixed, which changes the colour of the image*

the type of developer used.

In *chemical* development electrons in the developer are donated to the silver nuclei of crystals. This only happens in the case of those crystals which have some metallic silver on their surfaces, that is those which form part of the latent image. The electrons which are donated attract silver ions in a process similar to the forming of the latent image, though on a much larger scale. In this way the image builds up.

With *physical* development the developer usually contains some soluble silver such as silver nitrate. Whereas in chemical development the silver image is built up from silver ions actually in the crystal, with physical development it grows by adding silver from the developer. Many modern developers combine both types of development.

These processes affect only the exterior latent image as the developer does not normally have access to the interior one. So during film manufacture, steps are taken to encourage the formation of surface sensitivity specks. This is the after-ripening stage (see page 1190).

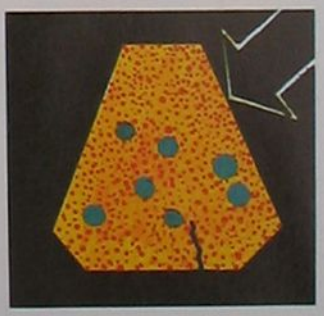
Unless development is stopped prematurely, the whole of an exposed crystal is reduced to silver. However, developers also act on unexposed grains by giving up electrons to the silver ions—chemical development—and if development is greatly prolonged the whole emulsion will eventually be turned black. It is the latent image which makes such a big difference to the ratio of reduction—rapid for exposed crystals, very much slower for unexposed ones—so that development can be timed to produce the clearest image.

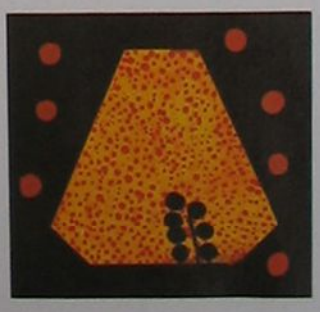
It is assumed that a silver bromide crystal must have a latent image speck consisting of a minimum number of silver atoms before it will develop within the normal developing time. The minimum size of the latent image speck depends on the degree and vigour of the development and a speck which contains too few silver atoms to 'initiate' development is called a *sub-latent* image.

A sub-latent image for one development condition may prove wholly adequate for a more vigorous developer or a longer development time. It is this fact that makes it possible to increase the effective speed of a film by push processing (see page 1544).

As long as sufficient development is given each halide crystal either turns completely black or remains unaffected. Tones in the final negative are created not by variations in the development of individual crystals but by variations in the number and sizes of crystals in a given area.

Formation of the latent image





All halide crystals contain defects such as chemical impurities or, as in this case, faults in the crystal structure. These defects act as traps for the electrons (blue) which are released when bromide ions revert to bromine atoms as a result of light striking the crystal. The electrons build up around the fault forming a negative charge. This attracts the positively charged silver ions (green) which combine with the electrons to form pure silver (black). This deposit of silver is the latent image as it is too small to be seen but acts as a centre for later development. The remaining bromine atoms (brown) diffuse out to a bromine acceptor such as the gelatin of the film, or later, the developer

Pete Meadows

Creative approach

Carnival time

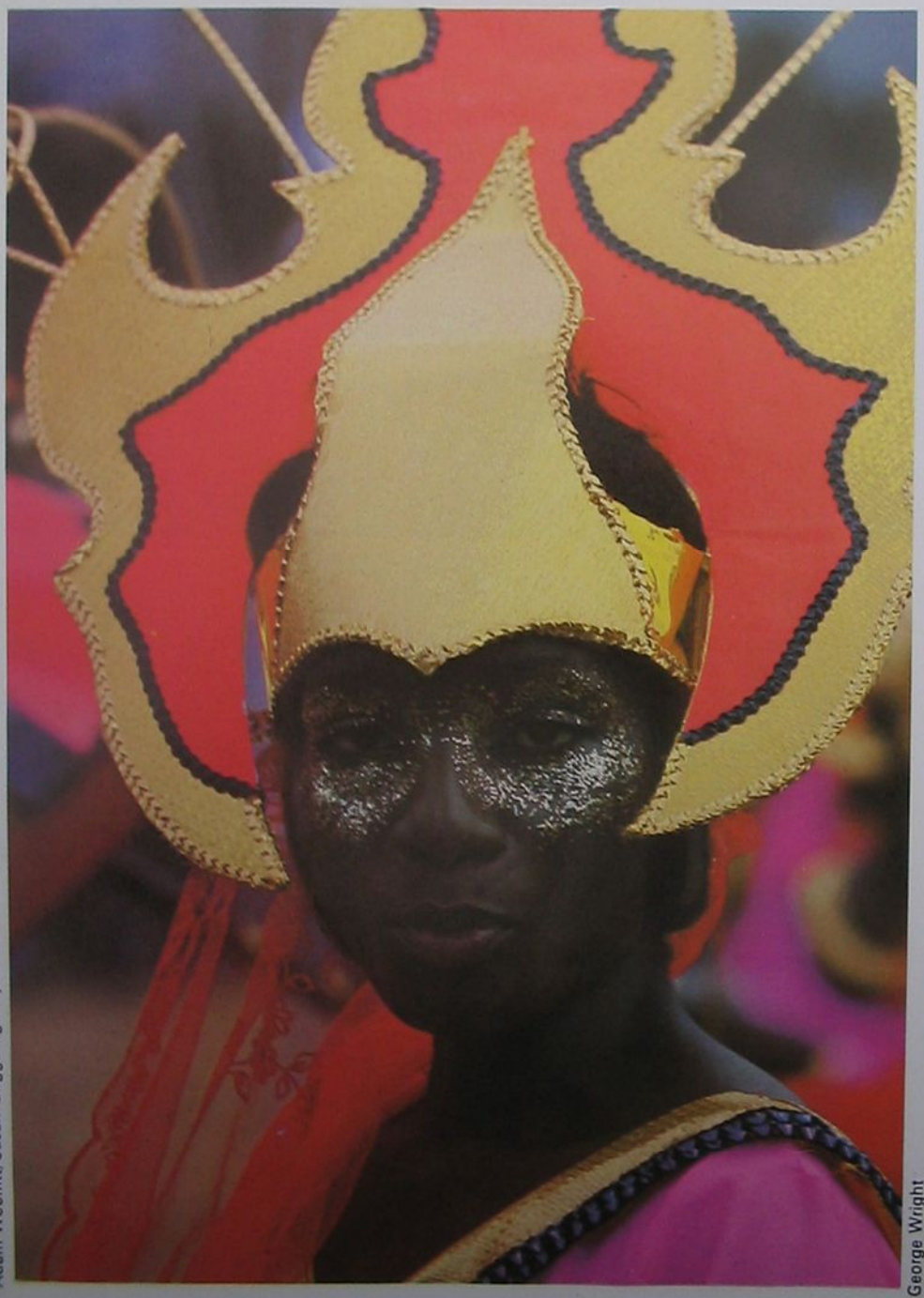
A carnival or procession is a particularly rich and varied time for photographic opportunities, but planning and preparation can make a vast amount of difference to your pictures

Carnivals and processions, whether as elaborate as the Carnival in Rio de Janeiro, or as homely as a local May Day Parade, are all ideal occasions for photography. In one place and a short space of time, they offer colour, excitement, crowds and the special interest of the particular occasion—in short, a rich concentration of photographic opportunities. These displays and celebrations invariably have a strong visual content, so that there is normally no shortage of good material for the photographer, and this, together with the fact that every one involved expects to be photographed, makes them easy subjects for the camera.

With a large number of possible subjects—and different ways of treating them—you may even have some difficulty in choosing which to concentrate on. Although there is no need to limit yourself to just one aspect of a procession, it does help to know in advance exactly what the possibilities may be.

Although each carnival or procession naturally has its own special characteristics, there is usually one focal point to the event—the high point of the occasion. In a May Day Parade, it would be the May Queen, or in the City of London's Lord Mayor's Show, the carriage of the Lord Mayor himself. Under most circumstances, this would be the one subject that you would not want to miss, and it will usually be best to plan the rest of your coverage of the event around this.

For most photographers, however, the most exciting aspect of a parade is the opportunity to photograph people. On such an occasion, the people taking part in the celebration are deliberately putting themselves on display, and are animated and generally in high spirits. As a result, no-one has any reservations about being photographed, and the



Adam Woolfitt/Susan Griggs Agency

Close-up *A telephoto is ideal for selecting one striking detail from the scene.* **Festival at Goa, India** *A strong shape makes an effective composition, while helping the subject to stand out against the background*
Carnival in Brazil *Try to find a high viewpoint—local contacts can be very useful here*
Chinese Dragon Dance *Going in close with a wide angle can give the flavour of being in the middle of the event*

George Wright

Claus Meyer/Colorific

common problems that you are likely to meet when photographing people in the street simply do not exist. Most participants are too involved in their parts to be shy or awkward in front of the camera.

This kind of event, in fact, makes an easy introduction to candid photography for anyone who feels embarrased when aiming a camera at strangers: in a parade, nobody minds, and the success rate in terms of good poses and expressions is likely to be high.

The main difficulty with photographing people at a carnival or procession is that there is likely to be a large crowd of constantly moving bodies. Your pictures can easily turn out to be a dense and jumbled mass without a focal point, although what you actually thought you saw at the time may have been a clear view of a single float, costume, or group of people. Selective focusing may be one solution but people at these events are usually moving so quickly and unpredictably that this may be difficult in practice. It may be best during a procession to focus on one spot and wait until people enter your focusing range. A zoom lens may help you to select particular details from the rest.

Alternatively, you can take the opposite approach and use a wide angle lens. This is useful in circumstances where you can move around and get close to your subjects. The wide angle allows you to use slower shutter speeds or to get

Cameraman/Susan Griggs Agency

Adam Woolfitt/Susan Griggs Agency

better depth of field than a telephoto, and can often help you to show all the action —maybe someone throwing flower petals into the crowd, for example. And a wide angle can often overcome distracting backgrounds by making them smaller in the frame.

Another valuable accessory in crowds is some means of shooting over people's heads. An aluminium camera case or even a wicker fishing basket can give you the extra height you need. Or you can hold the camera over your head and hope for a good aim, though in practice this can be tricky.

One aspect of processions that most casual photographers overlook is the preparation behind the scenes. People preparing and adjusting their costumes, lining up the order of the procession, or just relaxing with their feet up can provide some unusual views of the big day. By catching the participants off-guard, such as someone in elaborate historical costume lighting up a cigarette, you may have the chance of some candidly humorous moments. In addition, you may find that the way in which the procession is organized and rehearsed, and the details of how the floats, tableaux or decorations are actually constructed, are more interesting than the neat and ordered appearance in front of the public. Whether your photographs are printed and displayed, projected at a slide show, or even published, you will often find that, simply because of unfamiliarity, the audience will find this behind-the-scenes view particularly intriguing. For the annual Lord Mayor's Show in London, for example, few people know that the magnificent gold coach and full team of horses go through a dawn rehearsal in the deserted streets a few days before the event, with obvious pictorial possibilities. This may well happen in the case of other large events, and it would be worth finding out from the authorities concerned, so that you have a clear and uncluttered view of the proceedings.

Another subject to focus on is detail. Very often, people who photograph

Claus Meyer/Colorific

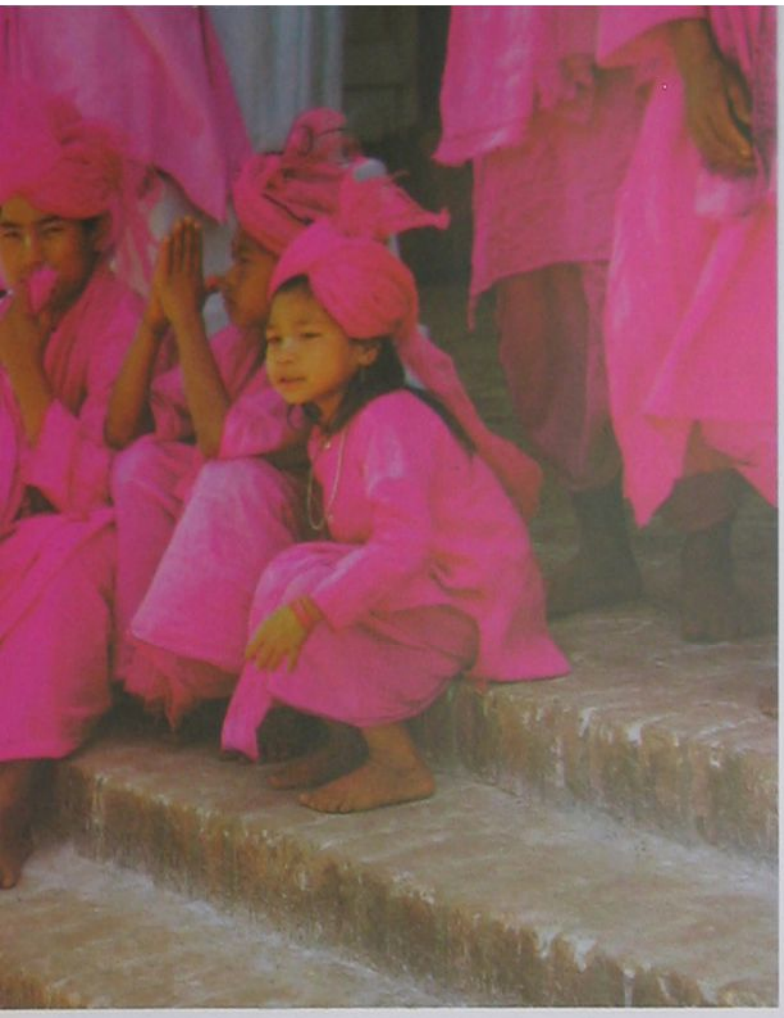
Dancing figure *A fairly slow shutter speed, such as 1/30 second, captures the impressionistic effect of a fast moving dancer.* **Trinidad Carnival** *It is worth filling the entire frame with an extraordinary and colourful costume, such as this one*

carnivals and processions concentrate on stepping back or fitting a wider angle lens to show an overall view of the event, ignoring the often intricate and elaborate costumes which can make subjects in themselves. Because processions are often organized on a fairly grand scale, and are usually seen quickly and not too closely, much of the detail gets lost, yet can be visually very attractive. In Rio's Carnival, for example, the costumes consume a great deal of effort and a sizeable proportion of the participants' yearly earnings, and would make a fascinating topic by themselves, apart from the dancing. On a less exotic level, the same often applies to carnivals nearer home. When concentrating on costume you will find that one area of the outfit may be worth a specially detailed picture, even at the expense of the rest. An outrageous hat, waistcoat or shoes, or a tail pinned on to a child dressed up as a mouse, are possible subjects.

The spectators lining the route can themselves be subjects for photography, and as the parade passes, look for reaction shots among the crowd. Also be ready for any impromptu moments—this is generally a good situation for candid photography, as the spectators will be so caught up in watching the procession that you can often photograph people from only a metre or two without their noticing. The carnival or procession itself is likely to be so colourful that a background of comparatively drab spectators can be a good visual contrast.

Of course, there is no need to restrict yourself to just one of these types of subject. Most parades and processions lend themselves well to a rounded, comprehensive treatment. By consciously trying to inject as much variety as possible into your coverage, you should be able to produce, by the end of the day, a successful picture essay. The essence of a picture essay is to cover all aspects of a subject, both in terms of content (the parade itself, preparations and costume details) and in pictorial variety with a combination of long shots, wide angle views, close-ups, subdued and strong colours. This naturally involves more concentration and more work, but the result, in which a selection of pictures balance each other, is generally worthwhile.

Having decided on how you are going to approach your parade in general terms, the key to success is your own planning and organization. This is because carnivals and parades are themselves usually organized quite tightly, so that your opportunities for photography are likely to occur in a short space of time, and in a limited area. Moreover, as these events invariably attract crowds, you will often find it difficult to move about—or even to get yourself into a suitable shooting



Jehangir Gazdar/Susan Griggs Agency

Michelle Garrett

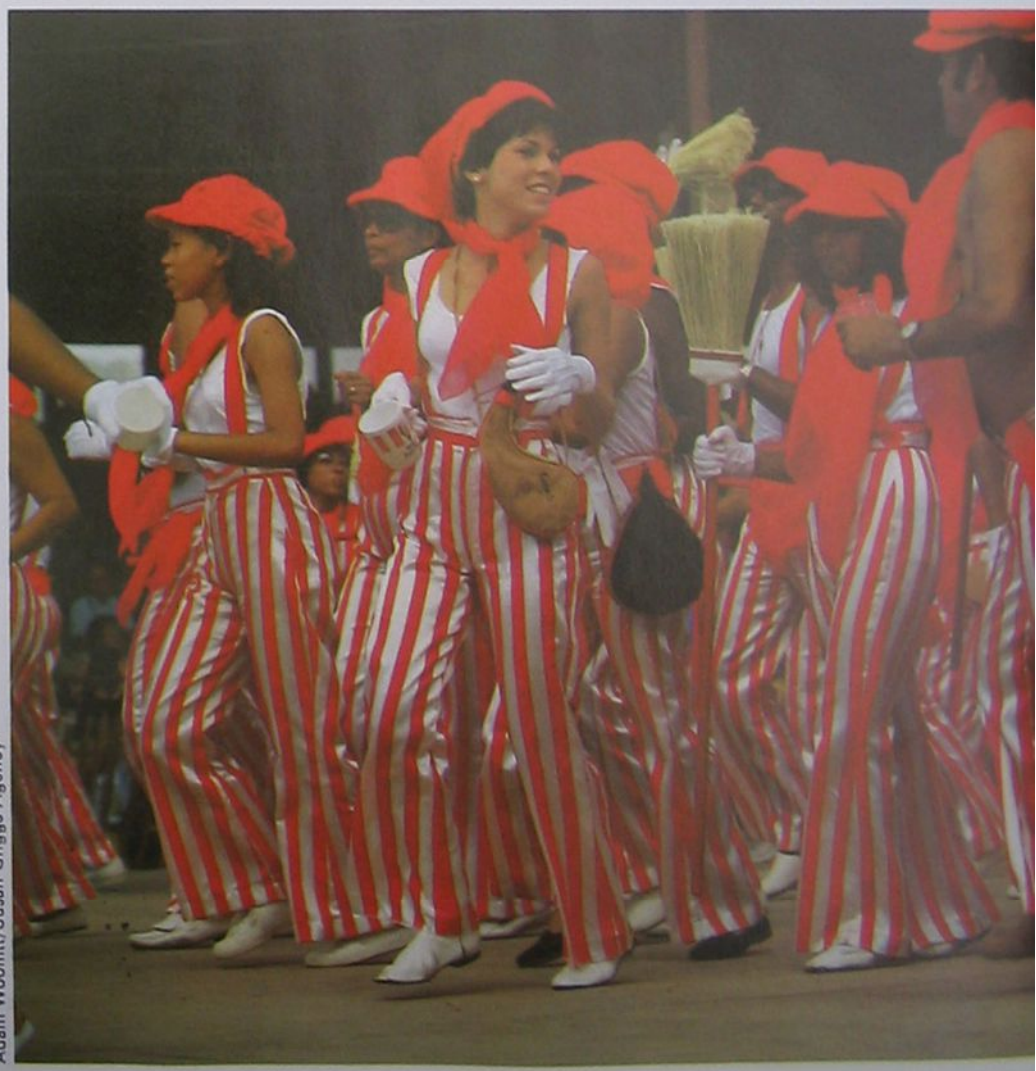
Festival of Holi, India *These little girls, absorbed in the activities, were quite unaware of the camera.* **Profile** *This shot avoids the pitfall of a poor background by using a long lens at a wide aperture*

position—once the parade is under way.

So, if you are going to take your photographic coverage seriously, you should work out your plan some days in advance. The first thing to do is to discover, as far as is possible, exactly what is going to happen, when, and where. In short, you need to know the programme, and for this, the best idea is to contact the organizers of the event (if you are in any doubt about who they are, the local tourist information office will normally be able to put you in touch). This is what a press photographer would do, and while there is no need to pretend that you are in competition with the professionals who are also covering the event, there is equally no reason for not giving yourself the same opportunity. Usually you will find that the organizers are helpful, and although you cannot expect them to give you a press pass and VIP treatment, they have a vested interest in publicizing their event, and so should welcome enquiries.

At the same time, if the event is an important or well-known one, look for any previously published photographs, in literature aimed at tourists, or in magazines such as *National Geographic*. This will give you some idea what type of event to expect. Armed with the schedule, you can then walk around the streets or park where the parade will take place, perhaps the day before the event. In the case of a carnival that moves along a route rather than stays in one place, check the timings, as it may be possible for you to move from one site to another in order to give yourself more than one opportunity of shooting a particular part of the event. In all cases, check specifically the best places from which to shoot the type of pictures you have decided on. These sites are not always as obvious as you might imagine.

On many occasions, the closest spectator position to the focal point of the proceedings will be the most desirable, and if there is any special seating for dignitaries, or an enclosure for press photographers, this is where they will be located. However, such a position, which you will probably not be fortunate



Adam Woolfitt/Susan Griggs Agency

enough to get, may also carry hidden disadvantages. It may give the clearest view, but not necessarily the most interesting. Certainly, if you are at an event that has already been photographed countless times in previous years, your main concern will be to produce fresher images, probably from a new viewpoint. In addition, if you manage to find your way into a front-row seat, it may be very difficult to leave it halfway through to look for different shots.

Some less obvious positions may, with a suitable choice of lens, be more satisfactory. For instance, by standing to one side and using a wide angle lens it may be possible to include both the parade and spectators in one all-encompassing shot. Or, a position too distant for normal viewing might be ideal if you use a long telephoto lens. Be careful, however, with important events where security is likely to be tight. On the day, police often clear people away from some positions on public buildings and monuments.

A high viewpoint, such as an upper-storey window or the roof of an overlooking building, is often very suitable, allowing unrestricted views of a large area of the parade. With a wide angle lens you can take a scene-setting shot, while a telephoto lens gives a choice of selective close-ups. The disadvantage of a high position is that you may be stuck there for the duration of the parade, with little opportunity of moving around for different shots. With a procession, when the interesting parts may pass very very quickly, this type of position will often allow you only a few seconds to shoot a particular subject.

If you are feeling energetic, you could try, as an alternative, to work out a schedule that enables you to start with the preparations, as the participants arrive, dress, form up, and then move on to strategic viewpoints along the route that give a head-on view of the procession. This will almost certainly mean that you have to move fast, taking back routes between the streets that the procession is using. How much you will be able to move freely will, of course, depend on how crowded the route is with spectators—there may be no problem at all with a local town parade, but at a major event the only solution is to arrive very early at the site and stay there.

Some of the places that you might want to photograph from may need special permission. If so, never be afraid to ask—you may be surprised at the help you receive. It is, however, important to make this kind of request in advance since the thing that really counts at these events is preparation and planning.

The equipment you take will obviously be influenced by what you intend to shoot, and where from. If you know that you are going to be in a fixed position, you might as well take as much equipment as you are likely to need—including a tripod, or a monopod, if space is very limited, as a useful and versatile support for a long focus lens. On the other hand, if your plan is to move quickly on foot, then you should take only what will fit easily into a shoulder bag. Wherever you shoot from, events will move rapidly to a peak and so a second camera body, already loaded with film, will help avoid missed shots.

Tor Eigeland/Susan Griggs Agency

Red and white *Sometimes there is no substitute for a front row position. A fast shutter speed freezes all the action.* **Festival in Spain** *A high viewpoint was essential here, as the viewer sees every face in the crowd and experiences the height of the act*

Special masks for contrast control

Rescue those valuable but difficult to print negatives and slides by using a straightforward but sophisticated masking process which allows you to control the contrast

Robin Scagell

Before and after masking *The print (left) was made direct from a particularly contrasty slide. To salvage shadow detail, a contrast reduction mask was made from the original slide, and this was used for the second print*

If you want really top quality colour prints but have to work from negatives or slides which have more contrast than can be accomodated by the print material you use, a printing technique using *contrast control masks* may be of particular use in helping achieve this.

This is how professional printers deal with high contrast negatives or slides which, on a straight print, normally show 'clogged' shadows or burnt-out highlights and—in the case of low contrast originals—dull, flat images.

While you can use dodging techniques for some control of clearly defined areas which are too light or too dark, these are of no help when it comes to 'bitty' areas. A contrast control mask offers precise control, ideal for a difficult print, with the added advantage that it allows you to repeat the results to make large numbers of identical prints—something you cannot usually do when dodging.

Contrast control masks for the amateur are simpler than those found in the professional laboratories, but normally call for special sheet films and developers—available through professional photographic or graphic arts suppliers, or to special order through your local dealer. You may find, however, that you can use ordinary sheet film and your normal film developers, but you will have to experiment a little. The sheet film must be a little larger than the original negative or transparency.

How contrast masks work

A contrast mask consists of a fairly faint positive or negative image on black and white film. It is produced by using one of several contact printing methods (see panel) to produce either a *sharp mask* or more usually, an *unsharp mask*, which is bound in exact register with the original image, and the resulting sandwich is printed as normal. The mask is made slightly unsharp so that slight errors of registration with the original are not so noticeable. This unsharp mask does not spoil the original in any way. In fact, an unsharp mask may actually accentuate the sharpness of the original. A sharp mask on the other hand must be accurately registered with the original so it does not affect areas of fine detail.

In masking areas of the image, a contrast mask acts very much like the card of a dodging mask. But with dodging masks, an area is either masked or not masked: with a contrast control mask, you have various densities of masking tones and the masked areas are precisely located according to the original. By controlling the nature of the tones in the contrast control mask—by varying exposure, processing or film type used for the mask—you can exercise a considerable

David Malin/Anglo-Australian Observatory

Eta Carinae nebula *Masking techniques are frequently helpful in astronomy. An unsharp negative mask was used to emphasize small contrast differences —the resulting bas-relief effect (right) seems to bring out much finer detail*

amount of control over the eventual contrast of the printed image.

The precise density of a contrast control mask depends on the relative contrast of the original slide or negative and the material on which it is being printed. If one matches the other exactly, there is no need for a mask at all. But if the density range or contrast of the print material is less than that of the original—which is always the case with slides—the contrast of the original has to be reduced by using a *contrast reduction mask*. This final mask is a positive image if you are printing from a negative original, and a negative image if you are printing from a slide. If, on the other hand, the original has low contrast and produces a lifeless, muddy image you need a *contrast increasing mask*. This is a negative image for a negative original, a positive image if you are printing a slide.

It is, of course, important to control the density of the mask carefully to produce the required effect whether you are reducing or accentuating contrast. It must have only a fraction of the density of the slide.

When the contrast of an original transparency is reduced, it is important to retain detail in the highlight regions, by making a special *highlight mask* first. This is bound in register with the original before making the contrast reducing mask. The latter is then registered with the original to produce the final print (see below).

Reducing contrast

If your original image does not have very important highlight detail, then you can use just one unsharp mask to reduce contrast. You make this by first adjusting the illumination at the baseboard by moving the enlarger head up and down on its column until you obtain a light value of 32 lux (equivalent, for example, to 9 on a Weston meter, reading from a perfectly white card). Then stop the lens down by four stops.

Make up your 'sandwich' with the unexposed mask film, emulsion up, at the bottom. The masking film should ideally be a soft gradation continuous tone panchromatic film such as Kodak Pan Masking film (4570), which must be handled in total darkness. But you can use a conventional emulsion such as Ilford FP4, if you are prepared to experiment with the exposure times. To prevent halation and contrast reduction, back the sheet film with black paper or card if you are projecting directly on to a white easel.

Select one of the methods shown for producing an unsharp mask—you may have to experiment to find the combination which ensures the right degree of unsharpness for your needs.

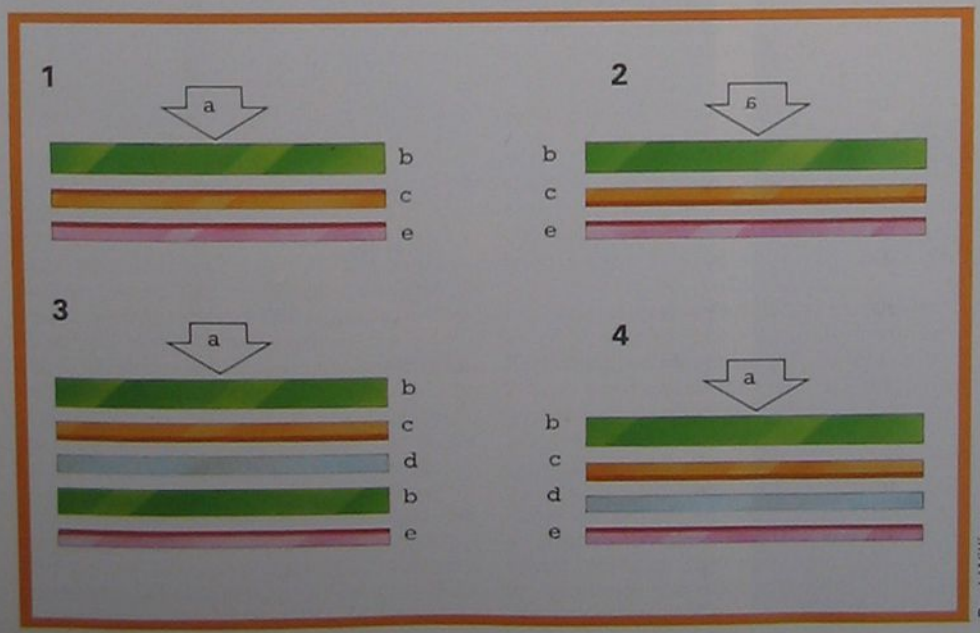
Give the film a trial exposure of ten seconds in the sandwich. Develop for three minutes at 20°C in a tray, with continuous agitation, in Kodak HC-110 developer diluted 1 to 19 from stock, or in DK-50 diluted 1 to 4 for 4 minutes. ID 11 or D-76 well diluted are alternatives; times depend on the sheet film used. Renew the developer regularly to ensure consistent results.

Rinse, fix and wash the film, then dry carefully in low heat, to prevent any stretching or distortion in the base. When dry, examine the mask—it should appear as a very thin, flat negative with little or no image in the highlight areas. If it does not show these characteristics adjust your exposure accordingly until you obtain them.

Highlight masks

When you are working with a transparency which has important highlight detail, the masking process is a little more complex. This is because the highlights in a transparency have a rather lower contrast range than the rest of the picture. When you make a duplicate or a mask, the contrast range is further reduced, and this can obscure detail. You must therefore reduce con-

Masking methods *Contrast reduction masks can be made in several ways, depending on the degree of unsharpness required.* **1** *Slightly unsharp contrast reduction and highlight mask compared with* **2** *a sharp contrast increasing mask.* **3** *and* **4** *are very unsharp masks using a plastic diffuser sheet. In each case (a) is the exposing light, (b) a sheet of glass, (c) the original slide or negative, (d) a diffusing sheet and (e) panchromatic masking film. Note which way the emulsion faces*



Paul Williams

trast in the rest of the picture while maintaining it in the highlights.

A highlight mask is a high contrast negative, with density only in the highlights—the rest of the image is clear. What the highlight mask effectively does is 'hold back' the highlights, so that they have no density in the final contrast reducing mask. When this mask is sandwiched with the transparency and printed, it affects the shadows and mid tones only and allows full exposure of the highlights on the paper, retaining brilliance and detail in those areas.

Use a high contrast film to make this mask—Kodalith Ortho is ideal, and can be handled under a red safelight. Set the enlarger as described above but reduce the output substantially. If you have a colour head, set high values on each colour setting to create a neutral density effect or, more simply, insert a neutral density of 2.0 and reduce the aperture by one stop. Remember to use a punch register system (see page 927), so that your mask can be correctly positioned after processing for exposure of the final contrast reducing mask.

Slight image diffusion is sufficient for this exposure, so you can simply place your original and the unexposed film, both emulsion side up, under the glass sheet. Again, suggested exposure time is ten seconds, followed by three minutes development in a tray of soft working developer, such as normal strength Kodak DK-50 or diluted ID 11/D-76, with continuous agitation. Rinse, fix and wash as normal.

When the mask is dry, you can locate it and the original transparency, emulsion to emulsion, between the glass sheet and the diffusion sheet. Expose the contrast reducing mask and process as previously described—you can now discard the highlight mask. Your final result should be a mask which enhances detail in your final print, while softening and reducing contrast in shadows and mid tones.

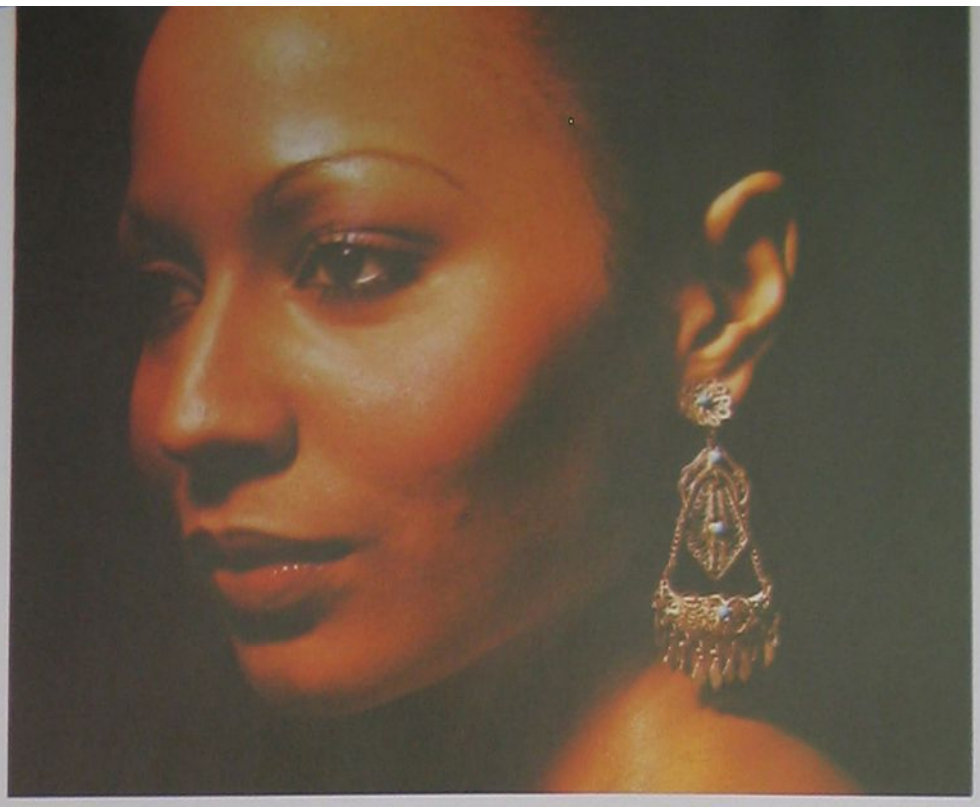
Increasing contrast

If your original transparency has low density and contrast, which you cannot control by exposure in printing, it will print a flat, low contrast image. Slide contrast can be increased by using a positive mask in printing; negative contrast is increased by using a negative mask. These add density to the shadows and the mid tones in printing, increasing the density range.

To make a contrast increasing mask, you must first make an internegative or interpositive—from this, the mask itself is made. The difference between this technique and that for reducing contrast is that the intermediate image, in particular, must be absolutely sharp or contrast is lost and detail obscured. Accurate registration of both internegative and mask is therefore essential.

Increased contrast *The negative for this normally yields a rather flat print (below left). Using an intermediate black and white positive, a negative contrast increasing mask was produced (below). This was sandwiched with the negative to give the final result (left)*

11 Marshall Cavendish



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Subtle improvement *Contrast control masking may also be used in some cases where the best possible print reproduction (left) is required. A faint contrast decreasing negative mask (below) helps to hold detail in the highlights (below left)*

Other uses of masks

Although masking is much more commonly used for printing transparencies, the technique is equally effective when applied to negatives—indeed, high quality colour printing from negatives often necessitates the use of masks. The same procedures apply exactly, except that you may find that blue filtration is required to correct for the integral (orange) mask of colour negatives. This can affect the correct proportion of colours of the three image layers of the negative.

Masks can be applied to other uses besides that of controlling contrast. They can, for instance, be used to control the contrast of the shadow areas only, or to reduce the contrast between areas of a picture. They are generally made either with less exposure or with more diffusion so that only the contrast of certain tonal areas is affected. The result is similar to that obtained by dodging, but there is the great advantage that the same effect can be reproduced every time.

Other masks can be made which increase or reduce the saturation of colours, and consequently their relative contrast. This is done by making contrast masks from a transparency through coloured filters—the original is then exposed through each mask in register, with filtration for each exposure. By varying these exposures, different contrast relationships between the colours can be obtained. The relevant techniques are covered in a subsequent article.

For both the masks, set the enlarger illumination as before—32 lux (Weston value 9) and close the lens by four stops. Sandwich a sheet of Kodak Separation negative film (4133, type 2) emulsion to emulsion with your original, remembering to punch register them both before exposing. Place them under the plate glass sheet and, again, give a trial exposure of ten seconds.

Develop in undiluted DK-50 developer for four minutes at 20°C. The resulting image should be crisp and show good detail in all areas. If your negative or positive does not show this, adjust the exposure until you obtain a negative which does. When you have a satisfactory internegative, sandwich it with another piece of the same type of film, in register, and give it a short exposure—1 to 2 seconds. Develop it as before. The resulting image should look underexposed, with no detail in the highlights and upper mid tone regions. If not, check the internegative again and adjust the exposure if necessary.

Printing with masks

When you have made the mask you require, sandwich it in register with your original transparency, using the register pins. The emulsion side of the mask should face the base of the transparency. Tape the sandwich together, and expose it exactly as you would normally do when printing. However, you will have to increase the exposure in order to compensate for the density of the mask.

Victor Watts

COLOURED FLASH

With a clever combination of electronic flash and lighting filters, you can tint the background of your pictures a vivid colour, leaving the foreground unchanged

Coloured filters are a very effective way of changing the colour of a photograph to achieve a desired effect. Unfortunately, when used on the camera, they filter the whole image and colour areas you may want to retain in their natural hues. But there is no reason why you should not put filters over an ordinary flashgun and direct it to colour just part of the subject. And by using several filtered flashguns together you can illuminate various areas in different coloured light to produce a brightly coloured picture from even the drabbest subject.

Even when you want to create a naturalistic look, it is often a good idea to filter the light from your flashgun—this can warm up the picture to give it a cosy glow, or compensate for colour in a ceiling from which you want to bounce the flash light.

Colouring the background

One of the simplest ways to use filtered flash is to colour the background while maintaining natural colour in the foreground. You could, for instance, use filtered flash to give an outdoor shot a deep blue background by loading your camera with tungsten-balanced colour slide film, and fitting a suitable orange filter over your flashgun.

The effect works by exploiting the tendency of tungsten light balanced colour film to give very blue results in daylight. If you use the filtered flash to illuminate the subject, only the background will have this very blue colour while the subject will be rendered in warm, natural colours.

This technique works best on an overcast day, or when the sky is blue and the sun obscured by clouds. Under these conditions, the light has a high blue content, and is not as bright as when the sun is shining, making it easier to balance the natural light with that of the electronic flash.

Choose a film with a fairly slow speed, such as 64 or 100 ASA (ISO), so that you can use the slow shutter speed necessary for flash synchronization without overexposing the background. The filter over the flashgun should be an orange 85B or its equivalent. Since the filter is not used over the camera lens, it need not be optically perfect, and you can use acrylic lighting gel. These are widely used in the film industry, and are available from theatrical lighting suppliers. They are made in a great variety of colours, but the best for this type of shot is a full orange gel, which converts light from a colour temperature of 5500 to approximately 3200K.

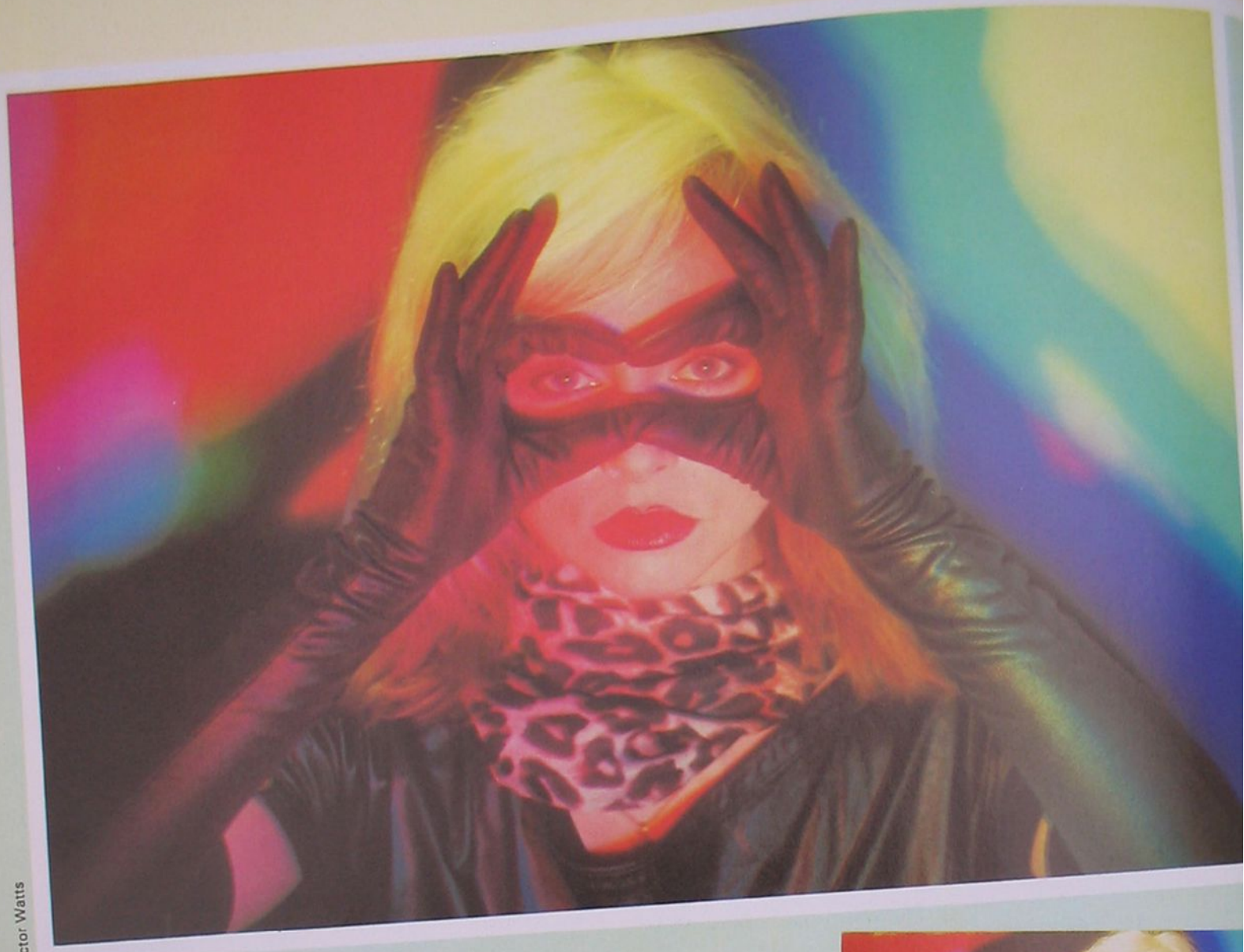
The exposure is made by both flashlight and daylight and these must be carefully balanced. Start by consulting the exposure table on your flashgun. If this is an automatic model, select an aperture of *f*/5.6 or *f*/8, and set this on the lens. Then take a meter reading to determine the correct shutter speed. Make sure that the shutter speed is slow enough to synchronize with the flash. If it is not, use the next smaller aperture offered by your flashgun.

By setting the shutter speed and aperture in this manner, you are assuming that the flash and daylight exposures are being made independently. Since they are not, and both are contributing to the overall exposure, you must close the aperture down by one stop, or the foreground will be overexposed. Finally, make a few bracketing exposures, changing the aperture setting one stop either way—if you change the shutter speed to bracket the photographs, the intensity of the foreground illumination remains constant, and only the brightness of the daylight-lit background changes (though you can use this to control the appearance of the picture).

With a manual flash, you must compensate for the light absorption of the orange filter—this means using an aperture two thirds of a stop wider than that recommended by the calculator dial or table.

Filter swatch *Acrylic lighting gels come in a staggering variety of shades and hues. They can be used on a flash, but not over the lens*

Victor Watts



Victor Watts

Alternative colours

If you want a background colour other than blue, a different technique is required to achieve it. To do this you must use a filter over both the lens and the flashgun. If the two filters are of complementary colours, the foreground will appear on film in its normal hue, and the background will come out the colour of the filter over the lens. You can check if two filters are of complementary colours by holding them both up to the light. They should look a neutral grey colour when you look through both at once. If they look any other colour, the foreground will be tinted in this same hue when you use them to take pictures.

Filter pairs which are specially matched for this technique are widely available, but if you have brightly coloured filters for contrast control in black and white photography, you could use these over the lens instead. Choose one that is the colour you want to tint the background, then go through a swatch of lighting gel filters until you find the complementary colour. Then tape a piece of this gell over your flash.

Deeply coloured filters can absorb a considerable amount of light—perhaps as much as four stops—so you must allow for this light loss when you calculate exposure. The TTL meter in your camera takes into account the daylight absorbed by the filter over the lens, but not that from the flash. The sensor in an automatic flashgun takes into account the light absorbed by the filter over the flash, but not by the filter over the lens. Unless the camera has off-the-film flash metering, you must compensate for the filter over the lens by setting a slower film speed on the calculator dial of your flashgun. The compensation needed depends on the density of the filter. You can measure this by taking TTL meter readings with and without the filter fitted to the lens. The difference between the two readings is the required compensation in stops. Once you have worked this out, and made the adjustment on the flashgun, you can determine exposure as before.

With a long time exposure, you can use this coloured background technique to make strange, surreal images with

Multicoloured model *The brilliant colours in the picture were produced using three flashguns, with the reflectors covered in red, green and blue lighting gels. Because these are the primary colours they produced white light where all three overlap, and yellow, cyan or magenta where the model obscured one of the guns. It is possible to produce the same effect with other colours, but beware of undesirable colour casts like the one in the picture directly above*

moving subjects, particularly if you take care to balance the daylight and flash-light exactly. The flash freezes the image of a moving object at one point in its path, and this sharp image appears naturally coloured. In addition, however, the time exposure catches a trail of the moving object, and this is rendered in the colour of the filter over the lens. As with all experimental techniques, you must be prepared for a little trial and error before you achieve successful results. So do not be disheartened if your first results are not perfect.

Additional flashguns

If you have access to more than one flashgun, you can use filtered flash to create even more special effects. Try using one gun to backlight your subject, with a strongly coloured filter over the reflector. This gun can be fired by a long extension cable or a slave cell, to form a halo of coloured light around the edge of the subject. Since it is only providing highlight illumination, it does not contribute much to the overall exposure, and providing it is not a particularly powerful unit, it can be ignored for the purposes of exposure calculations.

If you use two flashguns for front lighting, you can cover the reflectors with lighting gels in complementary colours. Where the scene is lit by both guns, the two colours combine to produce white light, and the subject appears in its natural shades. The shadow areas, on the other hand, are lit by only one gun, and they take on a colour cast which matches the colour of the filter over that flash.

In the same way, you can use three guns, and cover each with a filter in one of the three primary colours—red, green and blue—or their complementaries—cyan, magenta and yellow. Again, where the beams of light from all three flashes overlap, white light is produced, but in the shadows there is a colour cast. This is most clearly visible if the main subject is quite close to the background: if it is far away, the background will appear as a solid black. For best results, set the flashguns at least half a metre apart, or the shadows look very small and tightly packed.

Whenever more than one light source is used, the exposure must be adjusted to take the extra light into account. If you use two automatic flashguns with filters on each, you should close the lens aperture to one stop smaller than that indicated on the guns themselves. With three guns, you should use 1½ stops compensation. If you are using manual guns, the absorption of light by the from the film plane, and with these models, no compensation of any sort is needed—you can use them as if you are taking pictures with a single, unfiltered flash unit.

and the Nikon F3, measure flash directly coloured filters must also be taken into account when calculating exposure.

A few of the more recent cameras, such as the Olympus OM2, the Pentax LX

Filtering for realism

Besides filtering the light from your flash to produce an unreal effect, you can also use filters when you are aiming for very natural lighting. Bouncing light from a ceiling or wall is a very useful way of converting the harsh illumination of a flashgun to a more normal light, but coloured paintwork may give an unpleasant colour cast (see page 346). But as long as the paintwork is not too dark, a filter on the flashgun in a complementary colour can compensate for the unwanted colour. If you do not have the exact shade of gel that you want, aim for one which is slightly too yellow, rather than too blue, as warm colours usually look more pleasing.

Neutral density filters can sometimes be used to cut down the power output of a flash, particularly when working at close range. Even the smallest flashgun often needs an aperture of *f*/32 if it is used for macro work, and many lenses cannot be stopped down this far. Using a ND filter over the lens is not always the answer, since this prevents you from using any available light to illuminate the background. Grey lighting gels on the flashgun cut back light on the subject only. These acrylic filters can be used many layers thick, and one large sheet of 0.3 ND filtration can provide upwards of one stop cut in flash output.

Automatic flashguns frequently have a minimum working distance, below which they produce overexposure. Used in a similar manner, grey gels can reduce this minimum distance considerably.

They can also reduce the risk of reciprocity failure when using an automatic flashgun at short distances. Computer flash units control light output by cutting off the flash very rapidly when the subject is very close or pale in colour. The very brief flash that results cause a colour shift, but by taping ND filters over the flashgun, the duration of the flash is increased, and colour rendering returns to normal.

Calculating exposure

If you are using a filter to colour the background, and a complementary coloured flash to light the foreground, you may have difficulty in figuring out how much exposure is needed. Follow this simple procedure to arrive at the correct settings.

1 First, use the TTL meter on your camera to measure the light absorbed by each filter. Do this by taking a meter reading with and without the filter in place on the lens. The difference between the readings, measured in stops, with and without the filter gives the filter factor in each case.

2 Now consult the chart or dial on your flashgun to find the working aperture. For a manual flashgun you must take into account the light absorbed by the filter over the reflector—you measured this at step 1—but a computer gun compensates automatically.

3 Set this initial f-stop on the camera lens, and then open up the aperture enough to compensate for the light absorbed by the filter over the camera lens.

4 Finally, take a TTL meter reading in the normal way to work out the correct shutter speed for the aperture.

Remember that the shutter speed you use must be slow enough to synchronize with the flashgun. This generally means a speed slower than 1/60 or 1/125.

Robert Sleigh

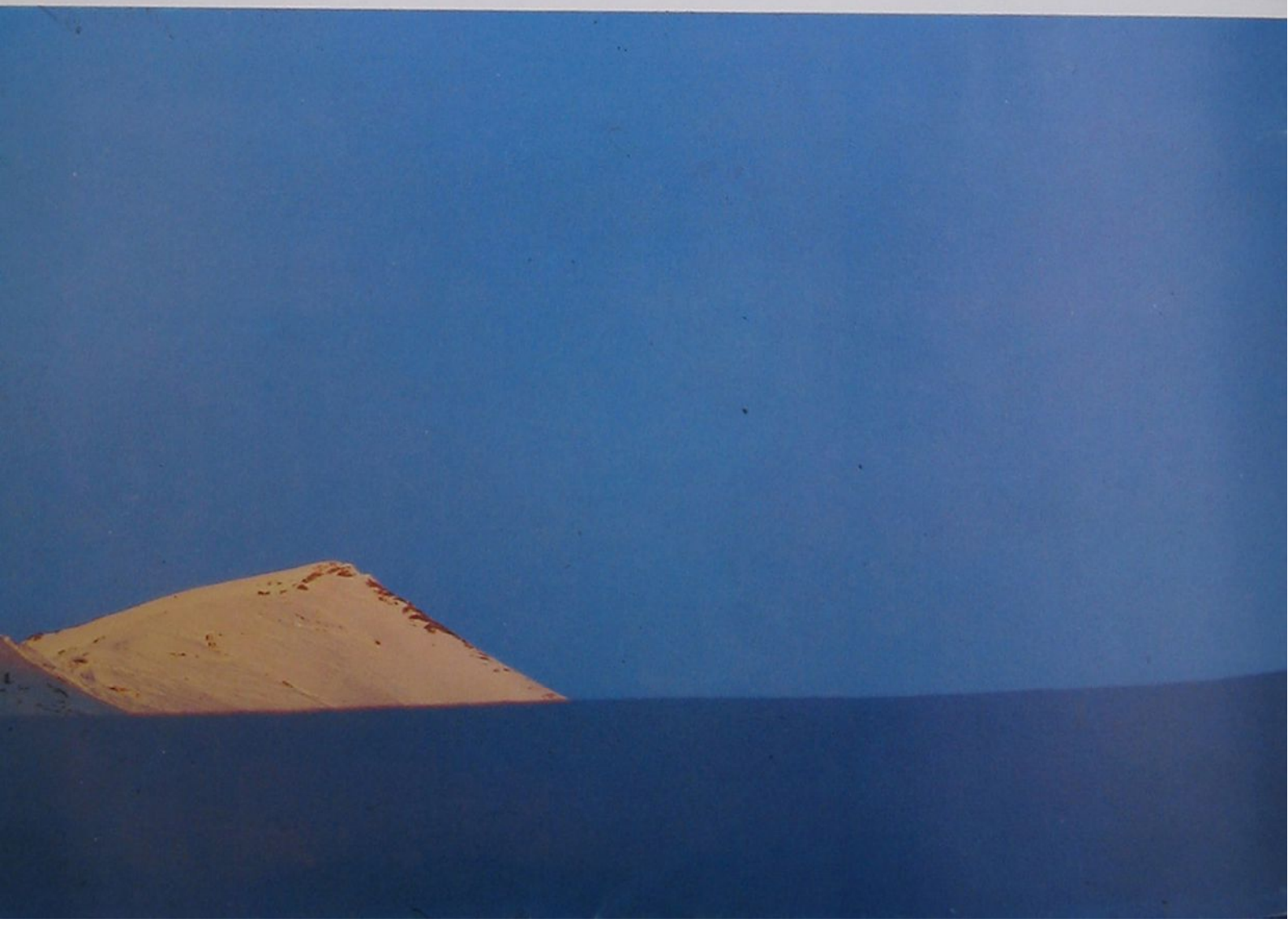
Balancing act *Several flashguns can be used in combination, by fixing them to a ruler or a piece of timber*

Assignment

Winter holiday

Professional Photographer John Sims illustrates how the snow covered landscape which many people encounter on a winter holiday can be exploited to produce some fascinating images

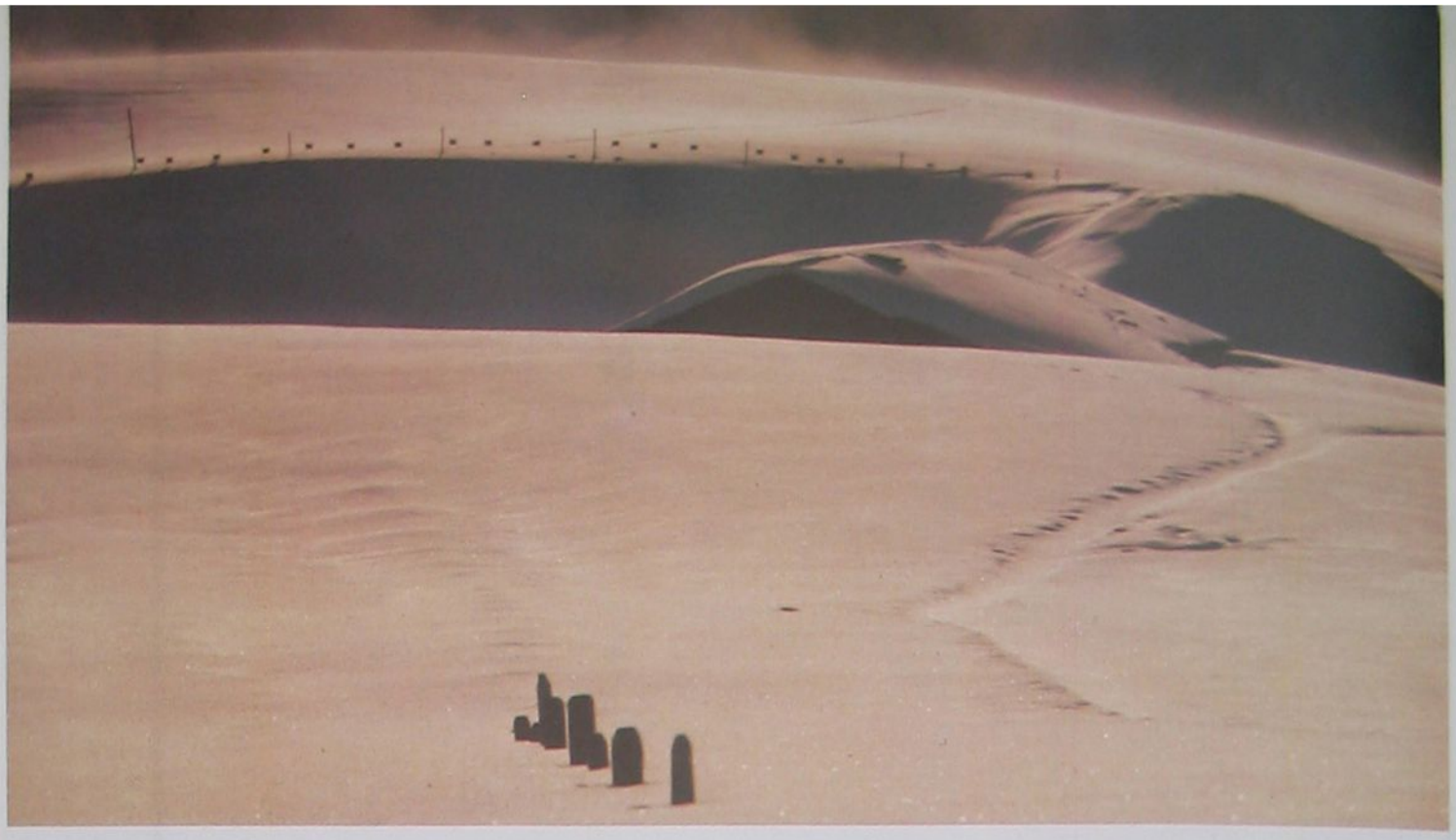
John Sims



A winter holiday is not only an opportunity to photograph skiing, but can also be a good time to photograph more unusual subjects—winter landscapes, abstract shapes made by the snow or details of the frozen scene. To explore these possibilities, we gave John Sims a free rein to shoot an assignment loosely based on a winter holiday.

Visiting Gstaad in Switzerland, John found that there was no shortage of subjects to photograph—the problem was more a matter of moving about in the snow and using cameras in the extreme cold. Also, in the Alps the weather can often change very quickly so that you can set off to take pictures in bright sunshine and, an hour later, find yourself beneath a ceiling of dense cloud. With such extremes of cold John also had to take care to

Chimney *John's eye was caught by the chimney (right) and the gentle curve in the snow line caused by the partial thaw. He used the 80-200 mm zoom to frame the shot precisely.* **Sunlit peak** *Another abstract shot has been created by giving prominence to this peak, lit by the setting sun. A strong base line has been included by featuring the foreground—once again, the sky is an integral part of the composition.*
Stacked chairs *Always keeping an eye out for interesting details, John was attracted to the patterns of the chairs, lightly dusted with snow.* **Skiers** *Shots like this really need bright sunlight and a blue sky. However, while backlighting is very effective, it means that you have to ski down below your subjects.*
Signposts *The shapes of the signs and the chalet in the background make an interesting composition that is also very characteristic*



John Sims

Snowscape *Exploiting the lifting mist and the smooth snow, John used the zoom lens to compose this chilly scene. Although only small parts of the scene, the posts in the foreground have been framed as prominent elements of the composition, giving the necessary balance to the background* **Evening** *A 24 mm lens included several subjects in this shot, but the main interest is in the different light sources—the magenta evening sky, a star and the contrasting illumination from the lamp. Mounting the camera on a tripod John used a ½ second exposure at f/5.6.* **Young skier** *Photographs of skiers are not as easy to take as they appear to be. It can be hard to find a decent viewpoint and it is even harder to focus on a skier moving rapidly towards you. But in bright light you can use a small aperture*

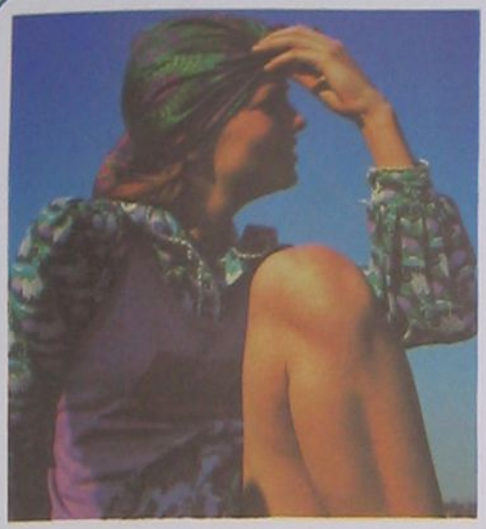
avoid allowing his skin to contact the metal surfaces of his cameras.

Combining skiing with photography makes a demanding assignment. Not only do you have to carry equipment but you also have to remain manoeuvrable—and hold the camera steady at the same time. For the strongest graphic effects, John found it best to go out straight after a fall of snow when the lines were clean and the ground undisturbed by footsteps. John kept his equipment to a minimum—a single camera body, a small tripod, plenty of film and 24, 35 and 80–200 mm lenses. He advised against carrying a newish camera body out into the extreme cold since the lubricants tend to be more viscous, making the mechanisms stiffer. He also added that taking equipment in and out of the cold frequently does it no good at all since condensation can ruin cameras and lenses.

What went wrong?

Outdoor portraits-1

More photographs are taken of people outdoors than of any other subject but outdoor portraits pose a number of special problems



Beware of introducing any element which distracts rather than adds to a a portrait. Even though this is a perfectly natural pose, the leg's prominence in the picture turns the picture from a straight 'head and shoulders' portrait into a poor glamour shot, worsened by cropping the picture bottom. A full length view is better

Potentially ideal combinations of subject and setting often lead to less than perfect pictures. Here, the sheer size of the tree dwarfs what is, in fact, the main subject. The full length portrait at this distance fails completely—it would have been better under the circumstances to concentrate the picture on the immediate area of the girl

When you take pictures of people outdoors, problems of colour casts are probably one of the last things on your mind. Yet that is exactly what has happened here—the strange orange glow on the child's face is simply due to light reflected off the inflatable dinghy. When you see the whole view, it looks less unnatural because the eyes adapt in response to the large area of orange

Three mistakes here: both subjects adopt a fairly static, middle of the frame pose; both are facing away from the camera; and the background clutters the composition

Strong sun causes deep shadows which can be a problem in outdoor photography—particularly with portraits where results can be very unflattering. Use a reflector or a nearby bright object, such as a whitewashed wall to perk up the shadow detail a little. Another problem of bright sunlight is that it causes people to squint involuntarily

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Francisco Hidalgo

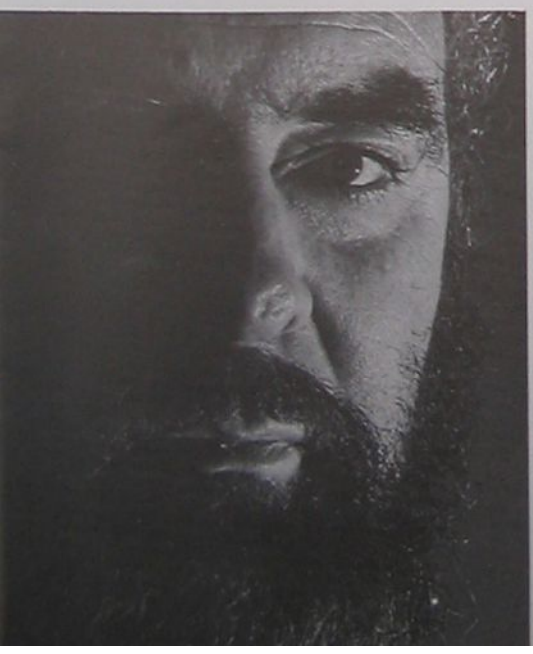
By using a highly individual approach, Francisco Hidalgo has built up a reputation for his photographs of some of the world's greatest cities. The impressionistic results are spectacular

Many photographers tend to think of multiple image pictures as something of a gimmick, but for Francisco Hidalgo they are almost a way of life and his atmospheric pictures of cities all over the world show just how effective multiple images can be.

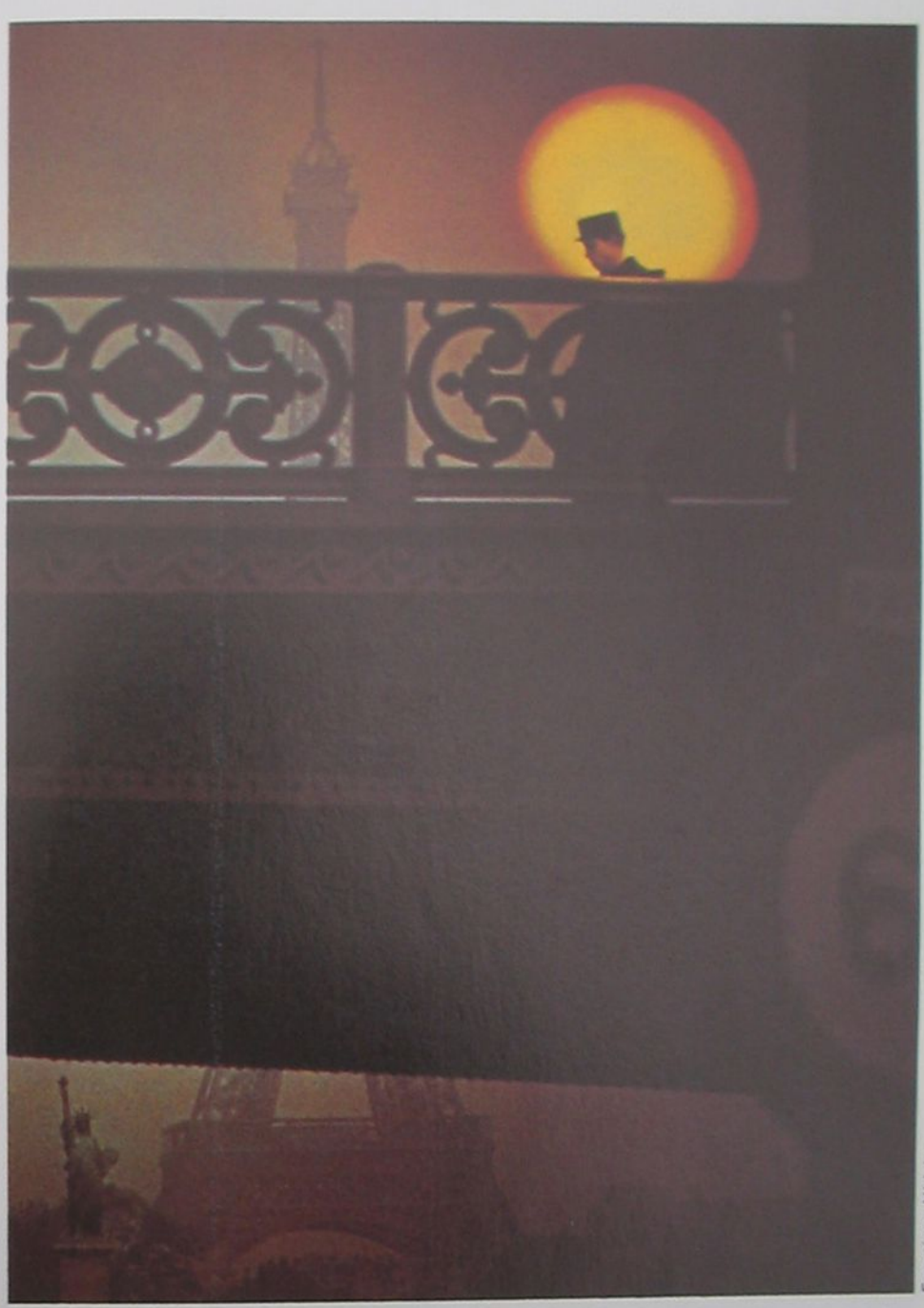
Hidalgo thinks of himself as 'an artist who uses a lens rather than a brush' and, indeed, some of his pictures have been compared to the impressionist paintings of Monet. Surprisingly, perhaps, his multiple images are never produced in the darkroom but always in the camera on a single negative and it is his ability to create and visualize the result before the shot is taken that is the essence of his success with this type of picture.

A tall, athletic man, Hidalgo was born in the Andalusian mountain village of Jaen, halfway between Cordoba and Granada in southern Spain, in 1929 and his childhood was spent in the shadow of the Spanish Civil War and its terrible aftermath. As a youth he went to art college in San Sebastian and later in Madrid, where he obtained a degree in Fine Arts. Although he now lives in Paris, there is no doubt that his Spanish upbringing is still very important to him and the artists he most admires are all Spanish—Velasquez, Goya and Picasso.

After he first moved to Paris in 1954, he worked successfully for many years as an artist and graphic designer for a television company and only took pictures in his spare time. But he gradually became more and more absorbed in photography and began to experiment with various photographic techniques. It was almost by chance that he moved into full time professional photography.



Kevin MacDonnell



Francisco Hidalgo

Parisian sunrise *Hidalgo (left) used a 200 mm lens, a Cokin A28 filter and a lot of patience for the image above*

One day in 1969, he was asked to do a picture for the front cover of a minor fashion magazine. The picture he created was a startling multiple image but was far too extraordinary for the magazine and the editor turned it down. But the editor of *Realités*, a leading French magazine, who just happened to be in the office at the time and liked the image very much. Soon after, *Realités* asked Hidalgo to create a front cover picture for them, and subsequently gave him many freelance commissions. Soon Hidalgo gave up his television job and began to take photographs full time.

Although he does a great deal of industrial and commercial work, he is now best known for his beautiful,

lavishly produced books on major cities and much of his time is spent travelling the world preparing material for these books. Unusually, the books are not carefully pre-planned. Instead, Hidalgo visits a city that interests him again and again until he has built up a large collection of photographs and then selects his favourites. Only then does he start to plan the book with the publisher.

Before visiting a city for the first time, he studies every book he can find on the customs, politics, general background and, especially, the arts. He feels, for instance, that an appreciation of Japanese drawings, paintings and carvings is essential for an understanding of Tokyo. In Hidalgo's view the architecture and layout of a city are reflections of a general way of life.

When he gets to his destination he walks, and walks, and walks. 'A comfortable pair of shoes,' he says, 'is just as important to a photographer as his camera—the only way to really discover a city is on foot because you can stop and go back, explore alleys and back streets and talk to people in a way that's impossible if you travel by taxi or bus.'

His latest book, *London*, is the result of years of work, hours of walking through the streets, talking to a cross section of the people, visiting museums, galleries and public buildings.

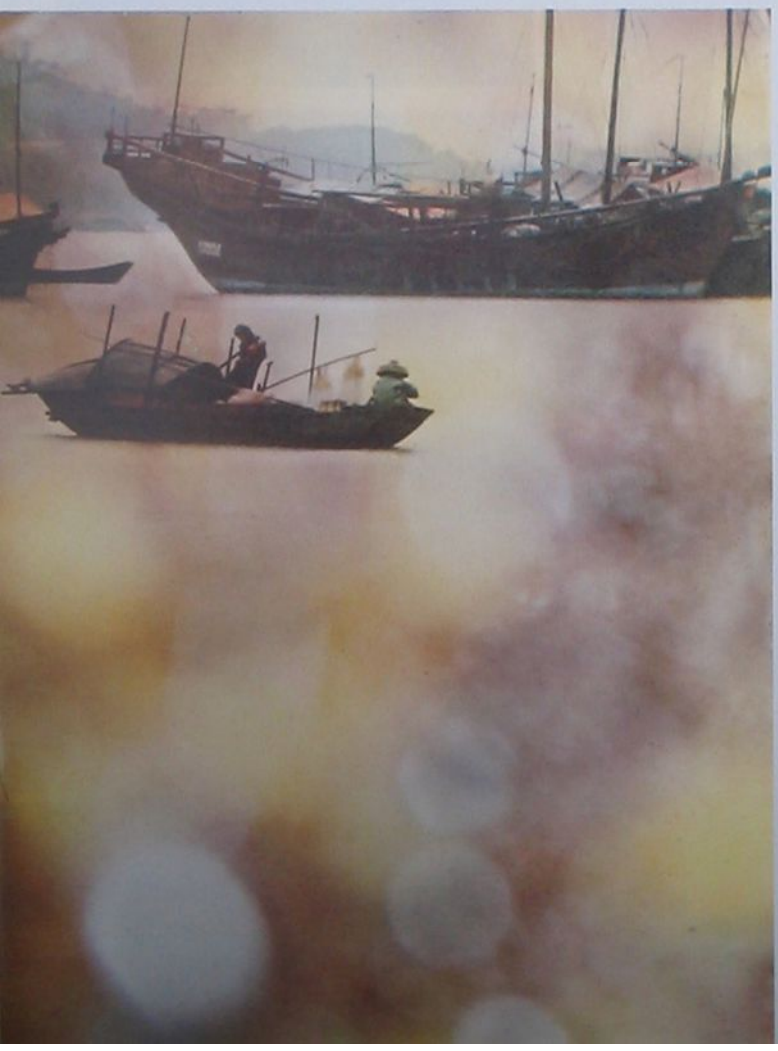
Hidalgo thinks London is a much more colourful city than is realized by the people who live there. Looking at his pictures it is obvious that he makes use of the red buses to provide a splash of colour wherever it is needed. 'You don't have to wait long', he says, 'before one comes along and then it's just a question of pressing the release when it's in the right place.' It sounds simple but the skill, of course, lies in deciding on exactly the right position and timing.

But it is his manipulation of photographic techniques—soft focus, filters, camera movement—that really mark out his personal interpretation of a city, and, in particular, his use of multiple images. He achieves these in a number of ways, and will vary his technique to suit the circumstances. Sometimes he makes multiple images of a moving subject on a single frame by panning the camera with a motor drive running at five exposures per second. Sometimes he fits two prismatic filters over the lens. But most frequently he uses a Nikon fitted with a motor drive and a perspective control lens set on a tripod.

He decides on the number of images he is going to record in the picture—that is, the number of exposures to be made—and then calculates the aperture and shutter settings for each exposure. He does this very simply by using a light meter to indicate the correct settings for

Empire State Building (*above*) *seen through the Brooklyn Bridge. Taken with a blue filter on a 500 mm lens*
Albert at the Memorial (*right*) *An effect produced with a graduated filter and a wide angle lens*

Francisco Hidalgo



Changing Guard (*above*) *Twelve exposures on one frame created this effect.* **Hongkong Harbour** (*below left*) *photographed using a 500 mm reflex lens and A27 filter to create a romantic effect.* **The rose window** (*below*) *at Notre Dame, Paris. 35 mm perspective control*

a single exposure shot and then reduces the aperture setting by half a stop for every exposure. If the meter indicated 1/15 second at *f*/2.8, for instance, he would reduce the aperture by three stops to *f*/8 for a six exposure picture : for a four exposure picture, the correct setting would be *f*/5.6.

To take the picture, he simply moves the front of the lens to each of the pre-planned positions, and makes an exposure to locate an image in the right place on the frame. The motor drive is essential because it minimizes the risk of moving the camera body between exposures.

As Hidalgo points out, none of his techniques are used simply for their own sake. 'There is always a good reason even if it's not immediately apparent to an onlooker'. Part of the challenge is to find the best combination for the most effective treatment of a subject. Hidalgo feels that every day 'brings fresh adventures' as he decides how to interpret the subjects he encounters, and experiments with new ideas.

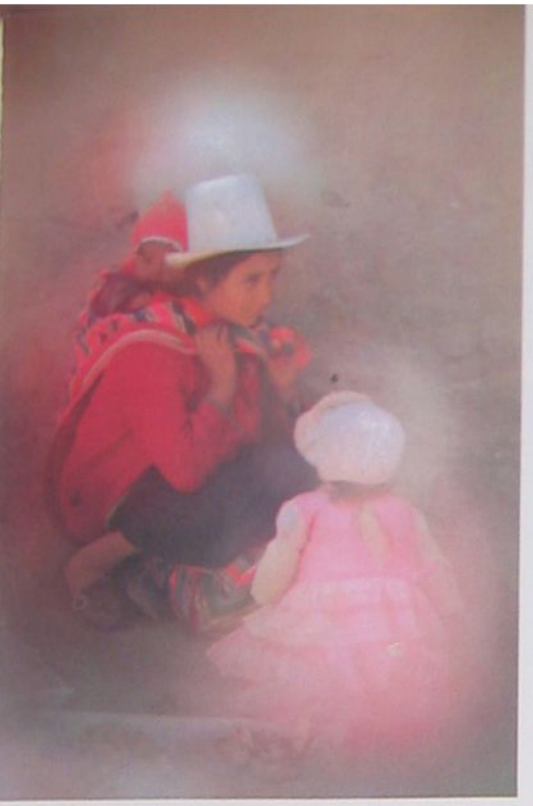
When out walking he carries a Nikon body with two or three lenses, but keeps more gear at base so that he can always return to a location with exactly the right equipment. He happens to like and use Nikons, finding some of the very compact SLRs have controls that are too close together to be handled comfortably—he really is a very big man! But he stresses that he could take his pictures with any camera, provided it could make multiple exposures on a single frame and could be fitted with a motor drive.

His lenses range from 8 mm fisheye to 1000 mm 'Big Bertha' telephotos. Much of his superb soft focus work is taken with an old Rodenstock Imagon lens that he had adapted to fit the Nikon, and he was very pleased to hear that because of the increasing interest in such lenses the firm is producing a 120 mm version.

He usually shoots on 64 ASA Ektachrome and Kodachrome. He rarely uses black and white film ; colour work calls for a completely different approach to that needed for monochrome—'it's just like the difference between painting and drawing'—and on the whole he prefers the visual excitement of colour.

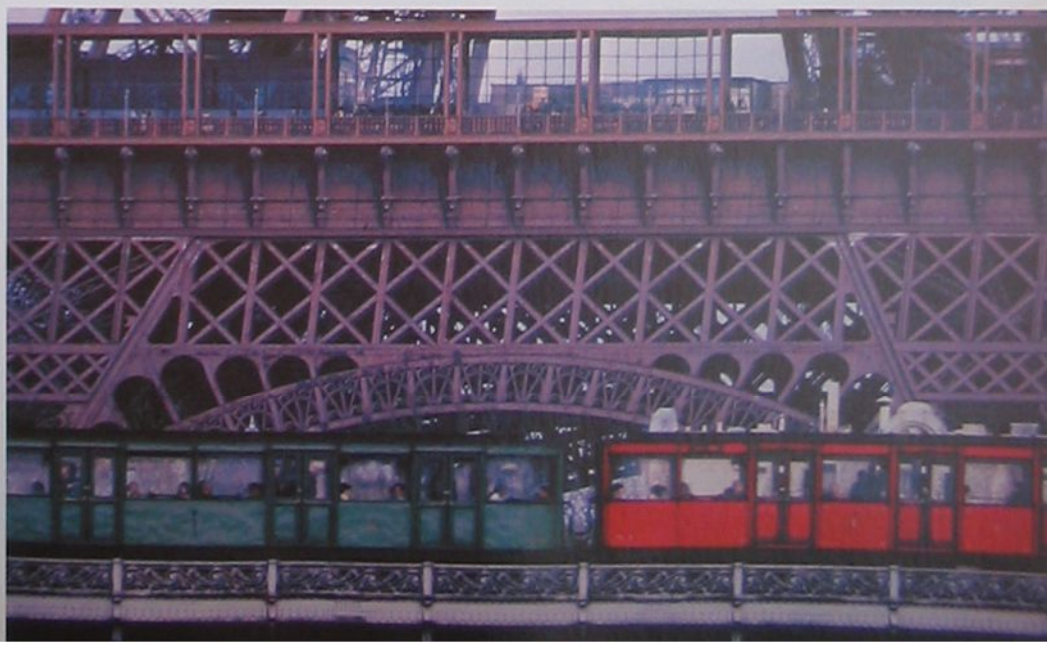
For all his colour work, he insists on close liaison with the printers when his books are produced and, unlike almost every other photographer, he prefers the appearance of the type of pictures produced by four-colour litho printing to photographic prints made from transparencies, finding the colours more saturated and accurate. He likes to inspect and pass the first proofs before the presses roll, something which takes time many people simply cannot afford.

As well as books, Hidalgo also sells individual prints of his work. He has held exhibitions of his work all over the world and the Cibachrome prints from his transparencies sell for substantial fees. He also supplies transparencies to the advertising and publishing world through the agency, Image Bank.



Francisco Hidalgo

Guard, Whitehall *(left) Shot using an 80-200 mm zoom lens. Hidalgo waited for the bus to pass to set the scene of a familiar London sight.* **Peruvian mother** *(above) A warm filter was used with an A87 soft focus filter on a 50 mm lens.* **World Trade Center** *(right) in New York. To shoot this picture of the Statue of Liberty, Hidalgo used a 200-600 mm zoom.* **New York skyline** *Another unfamiliar view of New York's Statue of Liberty, taken with an 80-200 mm lens and a yellow filter.* **Paris Metro** *Taken with a 400 mm lens. All the filters were Cokin*



Lightboxes and viewers

The more transparencies you collect, the more you need some means of selecting and editing them quickly. Viewing aids allow you to look through your slides easily without having to set up a projector

Whether you are editing a selection of transparencies for a show, or simply searching through your collection for a single image, there are usually occasions when you wish to look at your slides without setting up your projector with all its associated bother.

Although projection shows transparencies to their best advantage, it is certainly not the best method of viewing a large number of images in a short time. So when you want to preview rather than view transparencies, it is much more convenient to use one of the viewing aids available.

Viewing aids vary from the simplest of viewers—little more than plastic boxes to hold transparencies—to the most sophisticated colour corrected lightboxes. In addition to these, several types of magnifiers are available which can be used in conjunction with viewers to make detailed examination of transparencies even easier.

Dave King/loupes courtesy of Pelling & Cross

Loupes *include the linen tester (bottom) and the sophisticated Schneider. The pocket Agfa viewer (top right) can also be used as a loupe*

Viewers

The simplest viewer consists of a small plastic box with a focusing lens at one end and a diffuser at the other. The transparency is inserted in front of the diffuser and by holding the viewer up to the light and looking through the lens, you can see the transparency, usually magnified.

This type of viewer is small enough to fit into a pocket, and is inexpensive—about the price of a roll of black and white film. However, the image it shows is usually not of the best quality. Also, you have no control over the colour temperature of the light used to illuminate the image—and this is important for assessing the true colours of the image as well as for displaying it to best advantage. In bright daylight illumination should be satisfactory, but by artificial light the image will not be bright enough, consequently the colour temperature will be too warm and the image will appear dim and yellow looking.

The ideal colour temperature of light for viewing transparencies is about 5000K (see page 220), which is roughly equivalent to bright sunlight at midday—you cannot always obtain this if you depend on available light.

The problem of brightness—though not that of colour temperature—is solved by using an illuminated viewer. These take the form of a plastic box with a large magnifier at one end, and a small torch-type tungsten bulb behind the diffuser at the other. The viewer looks rather like a very small television, and you view the transparency by inserting it in to a slot at the top, which automatically turns on the light source.

These viewers have a magnification of between ×2 and ×12—at least ×4 is necessary for comfortable viewing. Some viewers have a switch which varies the light intensity and this compensates for transparencies of different densities. Viewers of this type are available for different formats, from 110 to 5 cm × 5 cm transparencies—some accommodate more than one format. Most have a facility for retaining the slide in the slot—some sort of clip—and for keeping the light on for an extended viewing time. The most sophisticated types take up to 36 transparencies at a time, which can be viewed in rotation. The majority of viewers plug into the mains, which is convenient and economical when the viewer is to be used for a fairly long period.

Viewers *Except for the Agfa pocket viewer, these all have their own light sources. The Unomat has a motorized facility for viewing a series of slides*

Dave King/viewers courtesy of Pelling & Cross

The advantages of this type of viewing aid are magnification and portability, as well as the fact that the light source is of constant brightness. However, they suffer from a number of disadvantages. Only one person at a time can see the transparencies comfortably, which can make selection slower and more tedious. A greater disadvantage, though, is that the tungsten bulbs are not colour corrected, and the light they give out is too warm, even though it is constant.

Lightboxes

If you want to look at several transparencies at once, for example when you are planning a sequence for a show, a lightbox is by far the most convenient way of viewing. Not only does it allow you to compare density, composition and other aspects directly, but more than one person can see the transparencies at the same time.

A lightbox consists of a wooden or metal frame with an opal glass or acrylic sheet top. Inside is the light source, which usually consists of one or more fluorescent tubes, according to the size of the box. These are normally switched on by means of a rocker switch on the frame or side of the box.

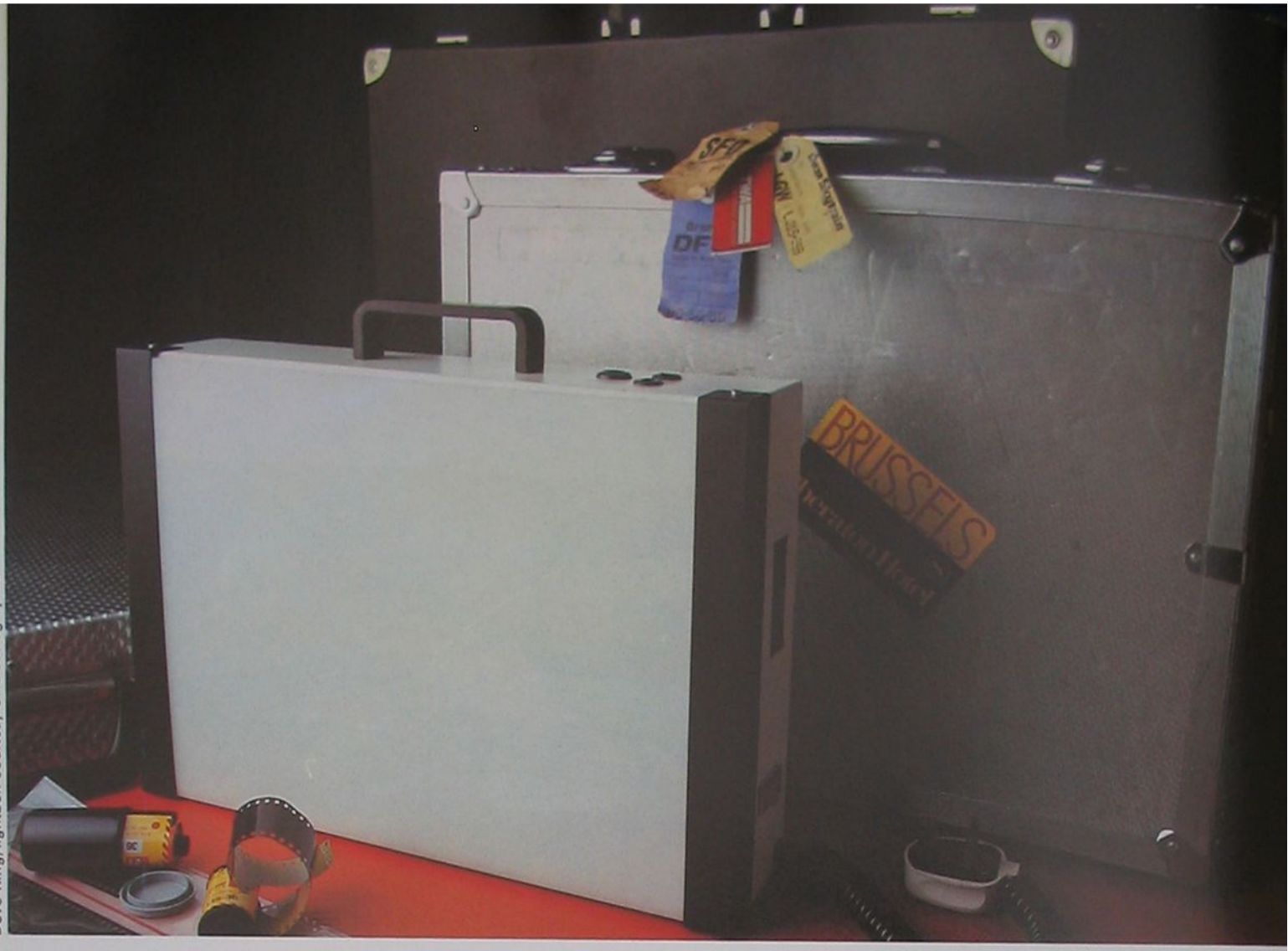
The screen on the top of the box acts as a diffuser, giving even illumination all over the top of the lightbox. Both glass and acrylic screens are equally suitable. Glass, however, is more fragile, and if you plan to carry your light box around a great deal an acrylic screen might be a safer choice. Though tougher, these require more care in use because they are more easily scratched than glass.

On the screen *The Agfa Diastar viewer projects a full, clear image on a translucent screen*

Dave King/viewer courtesy of Pelling & Cross

The fluorescent tubes of the light sources are available in a variety of colour temperatures, and under different names. They may be described as 'white', 'cool white' or simply 'daylight'. These all have different colour temperatures, so you should always check the temperature rating before you buy. Again, the ideal colour temperature is 5000K, and the lightboxes which have tubes described as 'colour matched' or 'colour corrected', such as Philips Graphic A tubes, give light of this colour temperature. Such tubes are more expensive than other white tubes available, so if cost is a limiting factor you may have to consider looking at other tubes of less than ideal colour temperature.

The colour temperature of tubes should remain constant for a minimum of 1000 viewing hours, but should it change after a long period of use tubes can be easily changed. However, for all practical purposes you can regard



Dave King/lightbox courtesy of Electrographic

colour temperature as permanent.

Some lightboxes are available which incorporate tungsten bulbs or tubes. You should avoid these—not only is their colour temperature far too low for viewing transparencies, but they generate a great deal of heat, which can damage the film emulsion and cause warping.

Lightboxes are available in a variety of different sizes, usually measured in standard paper sizes, from A4 (approximately the same size as one page of this magazine) to size A0 (16 times larger). Larger models are available and some manufacturers build to order. Generally speaking, a good all round size is A2—large enough to accommodate a good number of transparencies, yet still small enough for easy storage.

Most lightboxes are horizontal, and you view transparencies from above. One type, though, known as an 'audio-visual editor', has a screen which is angled towards the viewer. Channels running across the screen are fitted to prevent transparencies sliding off. This is a comfortable way to view slides and very convenient too, but the channels are fixed which means that you can only work with one slide format.

Other types of box are manufactured as well—one is built into a small table with legs, so that you can sit at it like a desk. Another type is built into a small case and can be carried around.

Lightboxes vary widely in price, so the amount you spend should be proportional to your collection of transparencies and the amount and type of work you plan to do. A small box, A4 size or thereabouts, should cost about as much as a lower to medium price telephoto lens, while a larger box, say A2, is around the price of a medium price SLR camera.

As well as for viewing transparencies, you can use a lightbox for retouching film and paper negatives, or transparencies. If you envisage doing this type of work, you might consider buying a lightbox with a dimmer control—you can then turn the brightness down for more comfortable viewing levels when working over long periods.

You can use a colour corrected box in conjunction with colour corrected tubes, mounted above the bench, to assess the colour accuracy of prints made from transparencies. By placing the transparency on the box, and the print under the fluorescent tubes, you can compare the two.

Magnifiers

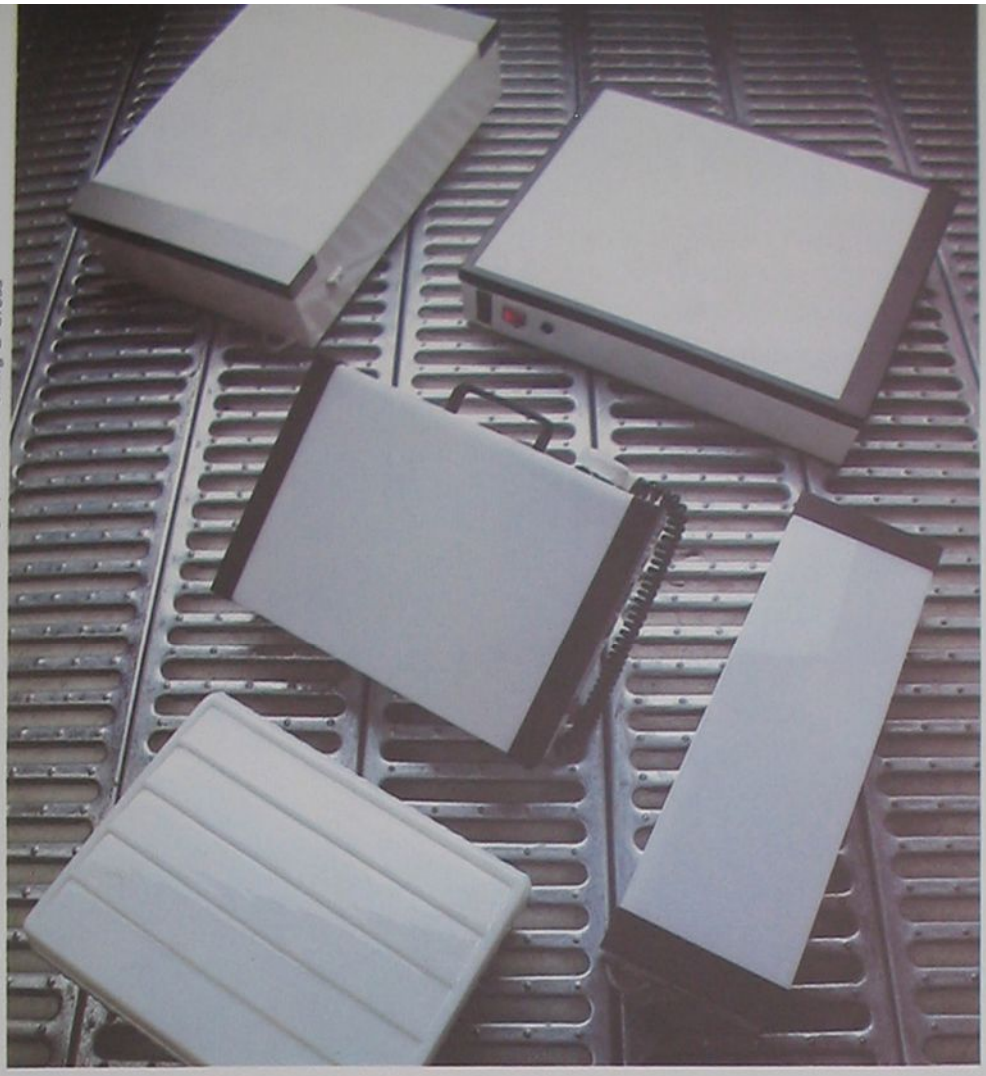
To see all the detail in a transparency viewed on a lightbox, you need a magnifier. The best choice is one of about ×8 magnification, and many such glasses are specially made for photographers.

Some of these, known as 'loupes', consist of a lens in a short tubular mount, which may be of black or clear plastic. These are placed over the transparency, leaving the viewer's hands free. The

Dave King/lightbox courtesy of Bush & Meissner

Portable light box *featuring a carry handle and mains lead. The colour temperature of 4300 K gives adequate colour balance and extra brightness*

Audio-visual editor *This compact unit is very light and is ideal for editing series of slides. The grooves stop slides from falling off the box*



Dave King/lightboxes courtesy of Bush & Meissner, Electrographic and Pelling & Cross

cheaper ones cost about the same as one of the simpler viewers. Some have very high quality lenses and a focusing device, and may cost twenty times the price of the more inexpensive types.

Another useful magnifier is an ×8 linen tester used for checking the quality of fabrics. This type folds flat, but opens out so that you can view in the same way as with a loupe. You can buy a linen tester for about twice the price of the cheaper loupes.

Before buying a glass, make sure that you check the quality of the lens. Many of the cheaper models do not show the whole transparency, or show severe distortion round the edge of the image. Avoid those which show colour fringes at the edges of the frame.

Larger size magnifiers are also available. These consist of a lens on a flexible stem, mounted on a heavy base or clamp. These are particularly useful for retouching work, as the space between the transparency and the glass allows you access, with a brush, to the image.

Which of these items of equipment you buy depends on your commitment to transparency work. If you just want to look casually over a few at a time prior to, or instead of, projecting them, then a viewer should suit your purposes. If, however, you plan to give many slide shows, or do a great deal of selecting, editing and retouching work, then a lightbox and high quality magnifier should suit your requirements.

Lightboxes *are available in various shapes and sizes, from the size of this page (foreground) up to that of a medium sized table*

Loupe in use *A magnifier and a lightbox are the ideal combination for viewing and selecting a large number of transparencies quickly and conveniently*

Dave King

Shape and form

The difference between shape and form is often crucial to the appearance of a photograph. You can sometimes emphasize one or the other in order to produce a more effective shot

Very often a subject is immediately attractive to the photographer because of a distinctive shape or form. These are also often the key features which distinguish a good photograph from an indifferent one. Yet even more often it seems that this particular quality is lost, or simply fails to stand out in the final photograph. So what are the differences between shape and form, how do they appear in a photograph, and how is it possible to decide what makes particular shapes worth including?

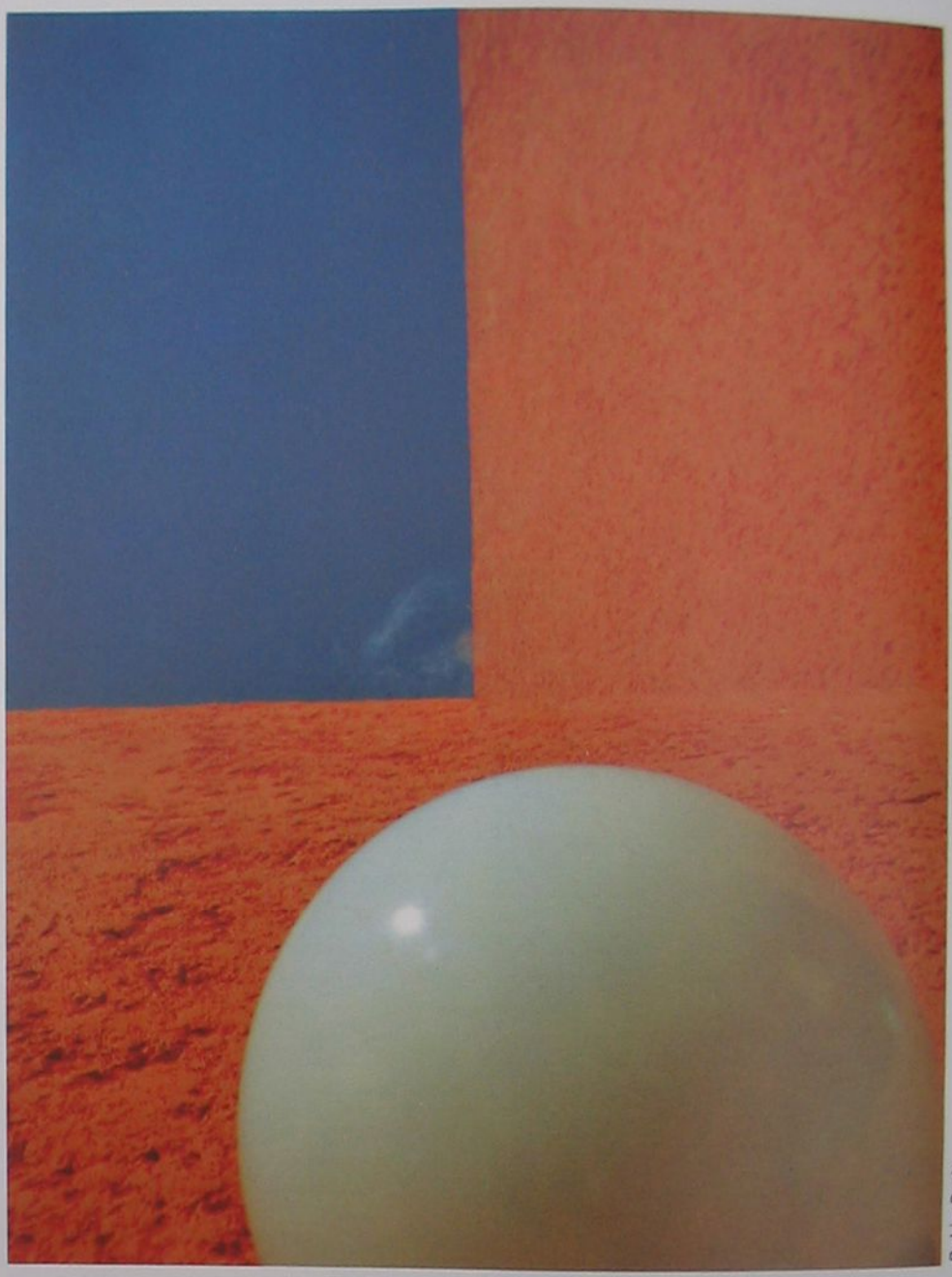
In looking at a photograph your eyes learn to interpret the familiar world in terms of line, tone and space. Shape and form are two of the main clues your eyes need to build up a realistic impression of the world. Shape is simply the two-dimensional outline that traces the subject as if it were a flat image, whereas form, on the other hand, gives the viewer much more information, showing the way in which an object occupies space in a three-dimensional aspect.

Drawings made by young children begin by being concerned only with shape. A house is seen as a box which has square eyes for windows and a door which is half way between a nose and a mouth, for instance. The same young child experiences form by touch, the roundness of an apple, for example, but showing this sense of form in drawing comes much later. This is not surprising, since it took great painters some centuries of trial and error before they discovered how to do this.

In photography, however, shape and form can be seen clearly through the viewfinder, but must be dealt with carefully if they are not to be lost in the photograph itself. When you are taking a picture, it often helps to identify the strongest feature of the scene and to try to make the most of it. You may be photographing a mountainside at dusk when the mountain itself stands out as a dark silhouette against a lighter sky. Clearly, in this case, the strongest feature is the shape of the mountain, and a successful picture will result from a careful exposure in which the shape of the mountain stands out sharply from its background. By moving your viewpoint, in this case, you may find an even stronger, or more interesting shape to emphasize, or you may find a spot where the foreground is clear of any distractions, or where the silhouette of a tree balances that of the mountain.

On the other hand, a few hours earlier, strong, direct sidelighting from a low sun may have given the same subject a completely different aspect. In this light the chances are that the strongest feature in your viewfinder would be the form of the mountainside, as deep shadows picked out texture and detail, giving the subject its full three-dimensional aspect. Clearly, one of the major factors that helps to distinguish shape and form is light, and the absence of light, or shadow. Shadows can depict form but can, in themselves, provide a dominant shape. An extreme example of this is the silhouette.

Once you decide that shape is the strongest feature and the most important consideration in your picture, you must also decide how best to communicate this to your viewer who will not be aided, as you are, by the recollection of the original scene. There are several ways to do this, depending on the nature of your subject. If your subject is mobile, you can choose your own background

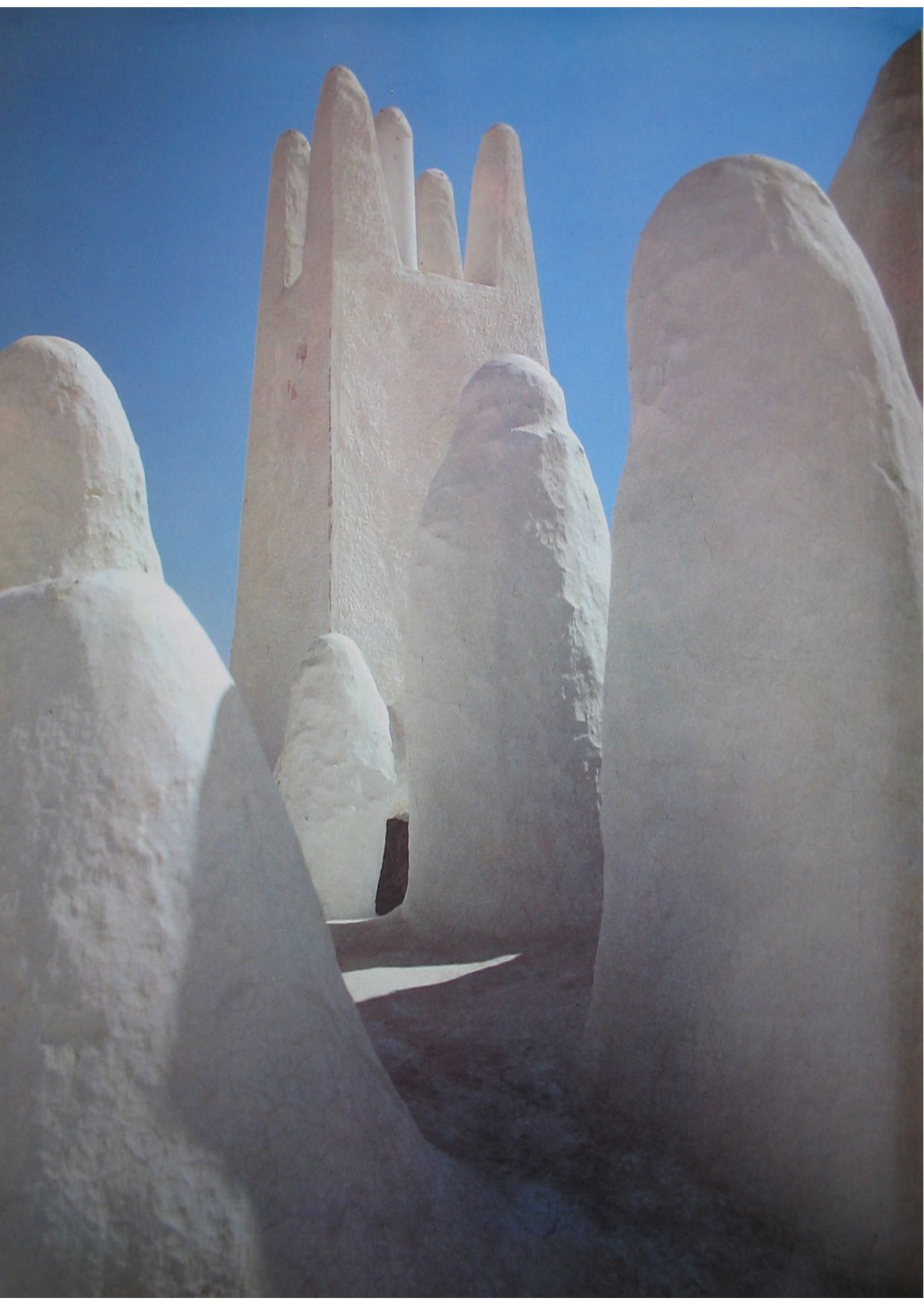


Robin Bath

What is it? *Actually, a lamp outside a nightclub, shot from below. This shows how simple contrasting shapes make an effective composition.*
Desert *Direct sidelighting, giving a mixture of highlight and shadow results in a strong sense of form.*
Trees and mountains *Outlining dark subjects against a light background shows shape but little form*

R. Grosskopf/Tony Stone Associates

H. A. Roberts/Tony Stone Associates



Neill Menneer

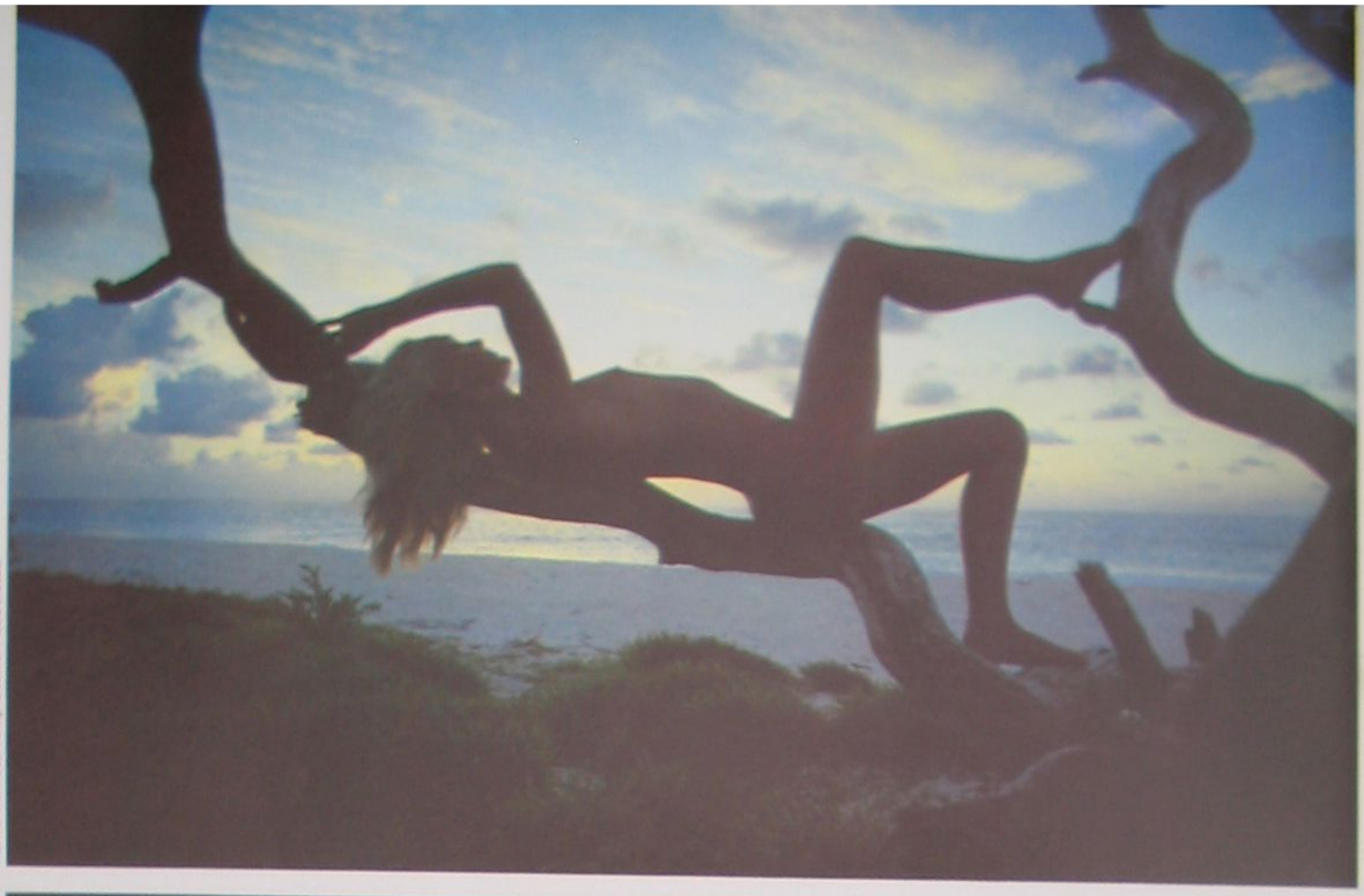
Jon Gardey/Robert Harding Associates

Robin Bath

White shrine *Strong directional North African light emphasizes form —the picture is almost 3-D in quality.* **Rusty drums** *The main appeal of this shot lies in the shapes defined by the colours of the drums.* **Log pile** *Though the sidelighting helps to define the texture of the subject, the shapes of the log ends are of greater interest than their form. This has been achieved mainly by very tight framing*

to make the most of a good outline. In most cases this means finding as uncluttered and plain a background as possible. Occasionally, a contrasting or complementary shape in the background may contribute to your main subject. The silhouetted shape of a fishing boat in the background may be complemented by the shape of a jutting pier in the foreground, for instance, and in this case you can move your viewpoint so that the balance between the two different shapes is more pleasing to the eye. A strong vertical shape, such as a tree, is often complemented best by a weaker, horizontal line in the background.

When dealing with a distinctive shape which is a positive enough subject in



David James/Tony Stone Associates

Ed Rooney/Tony Stone Associates

Out on a limb *The silhouette is a classic device for making the most of shapes. Here, the viewer is forced to compare the shapes of the nude and the tree.* **World Trade Center** *The angular frame helps to emphasize the shape of the building created by the low viewpoint*

itself, perhaps the profile of a swan, a clearly contrasting background colour can make the shape of your subject stand out. Make sure that the background colour is not so strong that it overwhelms the subject, however. The shape of a child's blond head may look very effective against a deep blue sky, but a violent red sunset may not be nearly as successful as a background.

Backgrounds can be a contrast to shapes not only in colour, but also in degree of sharpness. A crisply focused subject will stand out well as a shape against a blurred background, and there may be many occasions when it is very useful to use a wide aperture for this purpose. It is not always possible, particularly when taking candid shots, to move your subject or your viewpoint, and in these cases, when shape is of prime importance, a blurred background may simply be the best expedient. Panning the camera with a moving subject is a technique often used by sports photographers, when the shape of a subject, whether a hurdler, diver, or racehorse, needs to stand out clearly from a background crowd of spectators. The resulting streaking effect in the background gives a strong emphasis to a moving shape.

Changing viewpoint is one of the simplest and most effective, yet perhaps

Carl Purcell/Colorific

Footprint in mud *Shapes often need to be seen in full before they can be recognized. Without the imprints of the toes, this shape would lose most of its meaning. In this case, colours and textures alone define the shape—the lighting is soft, giving comparatively little form*

most overlooked ways of emphasizing shape. Move all around your subject, if it is possible, until you find the best outline, or until you find several good outlines, undisturbed by background details. This is easier with small subjects but with a large subject, such as a building, a lower viewpoint can often clear the background. From this low position you will notice that a shape is not only altered, but often given greater importance. If, therefore, you want your subject to assume a dominant position, direct your camera up towards it and you will find that it makes an extraordinary difference to its stature. A tall office block can take on the aspect of a pyramid and a modestly built person appear like a towering giant, albeit with a disproportionately small head. This technique is often used in films to give a certain character a dominating or menacing aspect.

If the level of the lens can alter the apparent shape of a subject, the type of lens can modify it, as well. A wide angle lens used closely is the most extreme example of this. Bill Brandt, for instance, has done a whole series of nude pictures using an extreme wide angle close to his model. The effect is to transform the shape of the limbs and the form of the model. This deliberate artistic distortion produces a remarkable result. Limbs appear to be massive pieces of sculpture. Stones on the beach appear to be huge, smooth rocks, although they are mere pebbles. But, in the distance, the same wide angle lens reverses the effect, diminishing the chalk cliffs so that they seem low and unimportant. As a rule of thumb, you can remember that the closer you move in with a lens wider than 35 mm, the wider the shape of your subject will appear to be.

Lighting is the most important factor when shape or form is the point of interest in the picture. Silhouettes are obviously the most dramatic way of emphasizing a particular shape, but you may not want this kind of drama in every photograph. While sunsets can give the darkest, sharpest silhouettes, do not overlook other occasions when backlighting of different types can give a silhouetted or semi-silhouetted shape just as effectively, if not so obviously. If your subject is in shadow but contrasted with a brightly lit background it will show up as a silhouette in a photograph if you expose for the lighter part of the image only.

A light subject against a dark background produces the opposite effect from the silhouette, but is no less effective when it comes to outlining shape. Occasionally your subject may be lit by bright sunlight although the background is in deep shadow. This is most likely to happen in a town or city when the light breaks through the gaps between buildings. Alternatively, you can manufacture this type of lighting effect by using flash in the dark. This works particularly well with figures outside against a night sky, giving a dramatically clear outline.

Just as light gives you clarity of shape, so it can be used to depict form, although a very different kind of lighting is used in each case. Generally, shape is best revealed by backlighting or frontlighting, but form is expressed with a mixture of highlight and shadow, such as is given by strong sidelighting. Still life, nude studies and detail shots, particularly of an architectural nature, are the principal subjects in which a strong sense of form needs to be expressed, even at the expense of shape. These are subjects in which it is usually important to bring out texture, a quality that benefits from exactly the same type of lighting. In the case of still lifes and nude studies, strong sidelighting can be created in a studio, or produced quite simply indoors by window light at an angle to the subject. Most architectural detail, and statuary in particular, is best shot in late afternoon sunlight when shadow and highlights are at their strongest.

Often you may find that the most successful images result from an equal concentration on shape and form. This is certainly true of portrait photography in which the aim should be not only to reveal the shape of the head, but the form of particular features. A dark background behind a well lit head shows up shape. Alternatively, a strong light placed behind the sitter shows up the shape of the head as being darker in tone than the background. Secondary lights from the side throw the features of the subject into relief, revealing the form. The more accurately form is depicted the more realistic, and therefore recognizable, the portrait.

As wide angle lenses tend to flatten the form of subjects, telephoto lenses give a more apparent sense of form, and are very often used for portrait or landscape shots in which the form of the image is the main consideration.

Understanding...

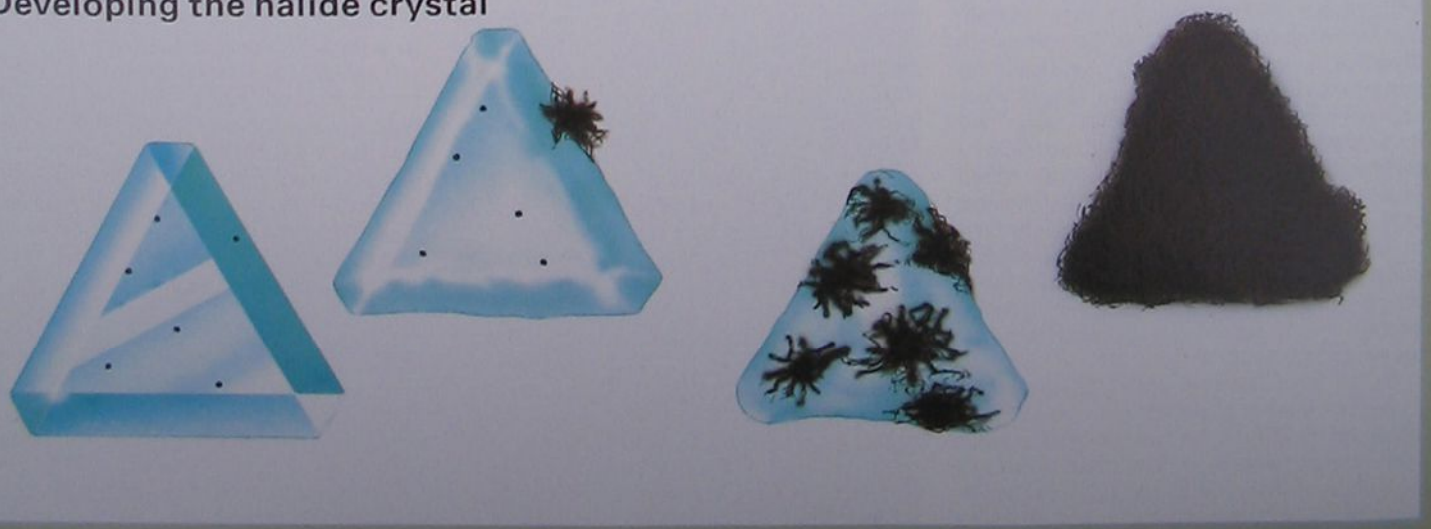
Developing agents

There are many different chemicals which can be used as developing agents. Each has its own characteristics, and agents can be combined to form a variety of useful developers

Nearly all photographers are acquainted with the use of developers, especially for black and white materials. But it is not often realized that many developers incorporate more than one developing agent—the principal chemical which produces the development effect—and it is the agents used and the way in which they are combined that give a developer its special characteristics.

Each developing agent has its own special qualities, but all agents have one essential property. First, they must all be reducing agents capable of converting silver halides to metallic silver which then forms the final images. But if they did this to all the silver halide crystals in an emulsion the result would be totally black prints or negatives. So another important property is that these agents have to be capable of distinguishing between those halide crystals which have been exposed to light and those which have not. The former must be reduced to metallic silver in a

Developing the halide crystal



matter of minutes but the latter must be reduced very slowly if a high level of fog is to be avoided.

Reducing agents

While there are very many reducing agents known to chemists which can reduce silver halides to pure silver, relatively few of them can make any distinction between the exposed and unexposed crystals. Fortunately, the situation is helped by the use of gelatin as a binding agent for the photographic emulsion. Impurities in the gelatin promote the formation of sensitivity specks (see page 1570) which make exposed crystals more susceptible to development than unexposed ones.

Of the 400 or so compounds which over the years have been suggested for use as photographic developing agents only a few are in common use today. The most important of these for black and white photography are *Metol, Phenidone* and *hydroquinone*.

Metol (methyl paraminophenol sulphate) is known by a variety of other proprietary names such as Elon, Planetol, Genol, Scalol and others. It is one of the most rapid working and active of developing agents. But this means that areas which have received comparitively little exposure tend to develop too much, resulting in low contrast, though this also means that Metol gives excellent detail in shadows.

Phenidone (1-phenyl-3-pyrazolidone) was discovered by Ilford Ltd in 1940. In many ways it is similar to Metol but is more active. Phenidone tends to produce a high level of fog, though it does have the advantage of giving an increased emulsion speed, as the speed of a film depends on the way it is processed.

Hydroquinone (paradihydroxybenzine) is different from the previous two in that it is slow acting and is often used as the sole reducing agent in developer formulae designed to give very high contrast—for line work, for example—though it usually requires the addition of a strong alkali to activate it (this is dealt with in a subsequent article). Hydroquinone is very often used in conjunction with an active developing agent such as Metol or Phenidone.

David Hoffman

Detail difference *Developers can be made to produce a variety of results. A soft working developer (such as that used for the picture on the left) gives a negative with low contrast but containing plenty of detail. A more contrasty developer (above) gives a more dramatic picture but much of the detail is lost, particularly in the tree trunk and branches*

Breakdown *The development of a halide grain is centred on the sensitivity specks. If sufficient time is given the whole of the crystal is reduced to silver*

MQ and PQ developers

Developers consisting of mixtures of Metol and hydroquinone or Phenidone and hydroquinone are universally known as *MQ* and *PQ* developers respectively. The old name for hydroquinone is *quinol*, hence the 'Q' in the two abbreviations.

By adjusting the relative proportions of the developing agents, developers with a range of characteristics can be produced. For example, a small amount of Metol or Phenidone plus a large amount of hydroquinone gives a contrasty developer. A large amount of Metol or Phenidone and a small amount of hydroquinone tends to give low contrast. Other factors have to be taken into account but this is the general rule.

When developing agents are mixed in this way the resulting solution has properties which are different to what might be expected from a simple mixture. This is because a phenomenon known as *superadditivity* occurs. The developing power of such mixtures is greater than the sum of the activities of the two components. A very small amount of Phenidone, for example, in conjunction with hydroquinone produces a highly active developer—whose energy cannot simply be put down to the small quantity of Phenidone. To a lesser extent the same effect occurs with MQ formulae.

The combination of a low contrast developing agent with a high contrast one, plus the effect of superadditivity, means that the resulting developer gives good detail in the shadows and mid tones, with a satisfactory highlight density, and all within a reasonably short time.

Special agents

However, MQ and PQ developers cannot be used for all photographic processes and sometimes special developing agents are needed. In the preparation of matrices for dye transfer work, for example, pyro or pyrocatechin may be used as a reducing agent in the tanning developer (see page 1351).

Pyro (also known as pyrogallol, pyrogallic acid and tri-hydroxy-benzine) produces an image which consists of silver plus various products caused by the oxidation of the developer. These by-products stain and tan (harden) the gelatin so that when the special film is washed in hot water only the undeveloped (unexposed) areas are washed away. Pyrocatechin has a similar effect and has the advantage of, if used with an alkali, giving fast development with high contrast.

Another important developing agent is paraphenylenediamine, which at one time formed the basis of a great many fine grain developers, although its main use today is as a colour developer.

Assignment

Paris

A problem with photographing a city as famous as Paris is that it is easy to end up with shots similar to everyone else's. Here Anne Conway demonstrates her individual approach to this celebrated city

Paris has a particularly magnetic appeal for photographers. But while it is full of character and colour, it can be difficult to find pictures that have not been taken a thousand times already. There is nothing wrong with, for example, straight shots of the Eiffel Tower, but, in many cases, such shots produce images that do little more for most viewers other than prove that you have been there. So we asked Anne Conway to take a personal look at Paris, to show how even familiar subjects can be given a fresh look.

Anne is an English photographer living in Paris. For her own photographs of the city she is always in search of something new—either by visiting the popular tourist spots only when the light is particularly dramatic or by turning her camera on less familiar scenes. For this assignment her only brief was to choose a day when she thought the conditions were well suited to photography and to spend her time photographing some of her favourite haunts.

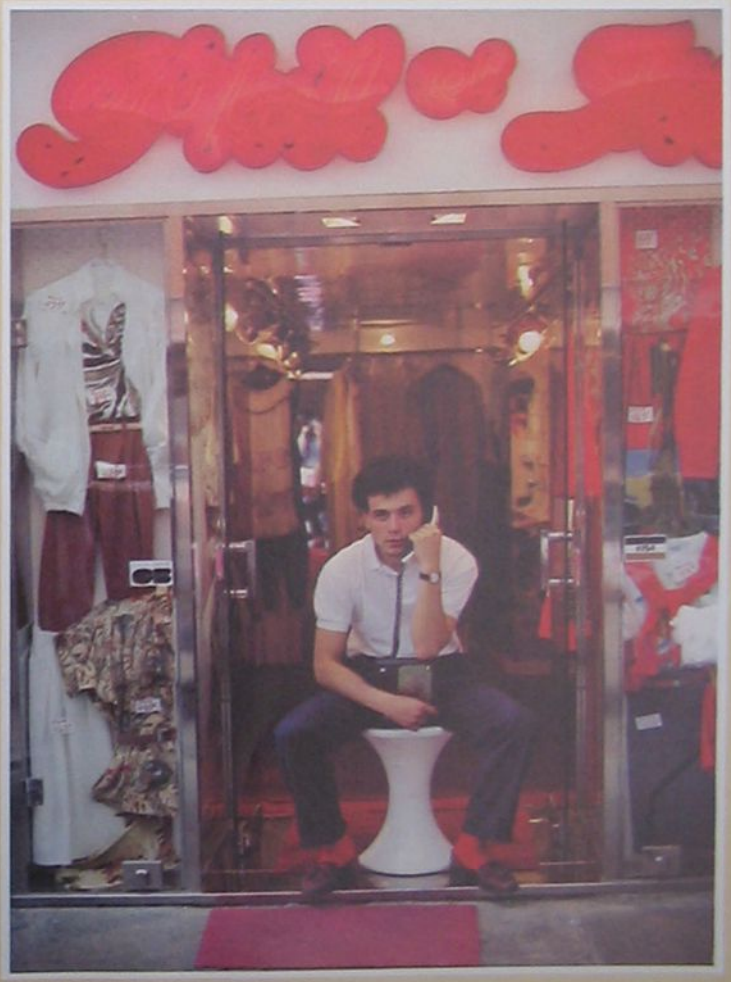
The day she chose dawned bright with the warm, low sunlight bringing life to even the most mundane subjects. She pointed out, 'I prefer this time of day and often make the effort to use this type of light. Usually by 11 am I give up and go home—the light is so flat around midday.' However, the stormy afternoon light was also ideal for photography and Anne exploited the rain and the menacing clouds to add atmosphere to some of the less well known parts of the city.'

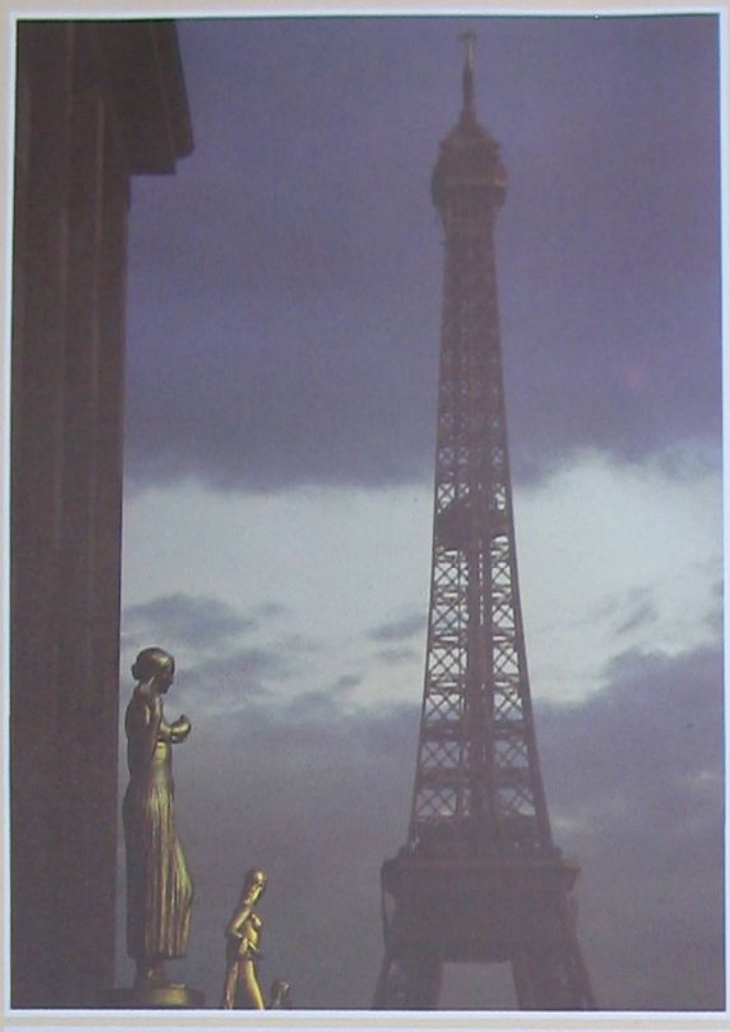
Most of Anne's pictures are of buildings and other static subjects, but during the day she also took a few candid shots. Usually, she finds that people do not mind being photographed in the street, but she is always careful to avoid those who look like they might take exception —she just has to take an educated guess about that!

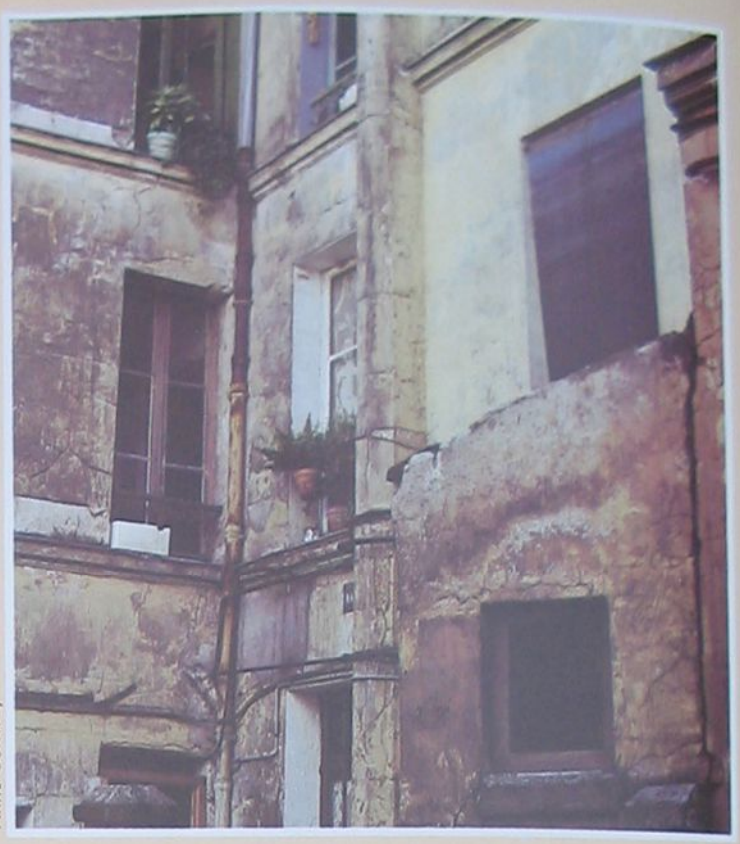
All pictures by Anne Conway

Outdoor café *Anne achieved this pleasing effect by shooting straight into the light with a 100 mm lens, Kodachrome 64, 1/125 second at f/8.* **Bronze arm** *Here an unusual viewpoint and careful composition made a familiar scene look unusual, 28 mm lens, 1/60 second at f/8*

Sunlit trees *The morning light created an atmospheric shot of two gendarmes walking in the Luxembourg Gardens.* **Rain** *After a shower Anne used a 28 mm lens to include the Eiffel Tower, some people and their reflections.* **Telephone** *Anne fitted a 50 mm lens for this candid*

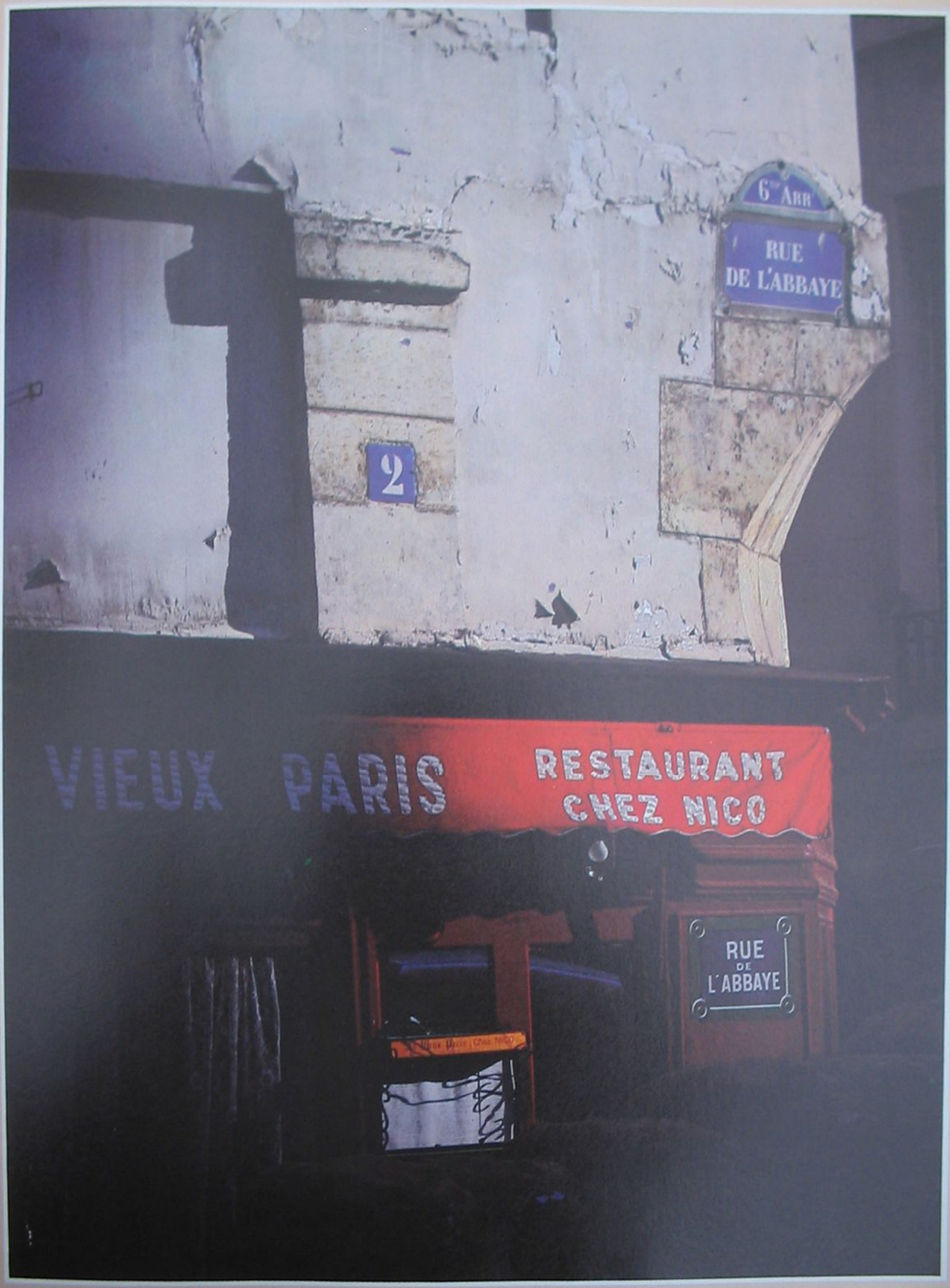






Anne Conway

Eiffel Tower *As extra pictorial elements, the stormy sky and patches of light were included in this carefully composed shot.* **Backstreet** *The texture of these buildings was brought out by the 100 mm lens.* **Stormy sky** *The sky and the light turn a mundane setting into an evocative image*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Giant transparencies

Using conventional equipment, you can make giant transparencies from your favourite slide film images and show them against a light source for an arresting display

Ray Duns/location courtesy of Kodak Ltd.

Reception display *Large transparencies have an arresting quality which makes them ideal for a wall mounted display*

Colour prints rarely have the brilliance and coloration of transparencies, and this can be a real handicap when colour negative originals have to be used to produce prints for display purposes. But a large, print-sized transparency on a lightbox has a great impact in a display, unmatched by small transparencies or ordinary prints.

You can get round the problem of one and enjoy the benefits of the other by printing your colour negatives directly on to a special material called *print film*. This material is designed specifically for making contact slides or larger transparencies from your colour negatives, and for best results it is advisable to match the make of print film you buy with the negative stock you most commonly use. This film is not cheap, at about five times the cost of conventional colour printing paper, and you may have to order it specially.

Handling print film

At first sight, it may seem a simple matter to use print film—its general characteristics are similar to colour print material. But it is coated on a film base and is usually processed in colour negative chemicals. Kodak Vericolor Print Film is processed in Flexicolor (C-41) chemicals. Furthermore. Processing times are generally longer than for paper prints.

There are differences when choosing the filter pack, too. Usually the sensitivity of the film is biased to require a magenta and yellow filtration when printing normal colour negatives, and it needs about twice the exposure of colour paper.

A further complication with this material is that altering the exposure times can cause apparently inexplicable variations in colour balance even though the filtration has not been touched. This is caused by reciprocity failure. The three colour layers react differently to a change in exposure time of even as little as 25 per cent and noticeable changes in colour balance may occur. It is important, therefore, to establish the correct density before making your final colour adjustments.

This leads to additional complications if you want to print in, or shade out certain areas of a picture. Any substantial change in exposure time to the parts of the picture may cause a shift in colour balance. The amount of change will depend upon the percentage increase or decrease of exposure duration to the affected areas relative to the overall exposure time. Some makes of film tend to become less yellow

with reduced exposure time, while an increase may result in a warmer or even magenta bias.

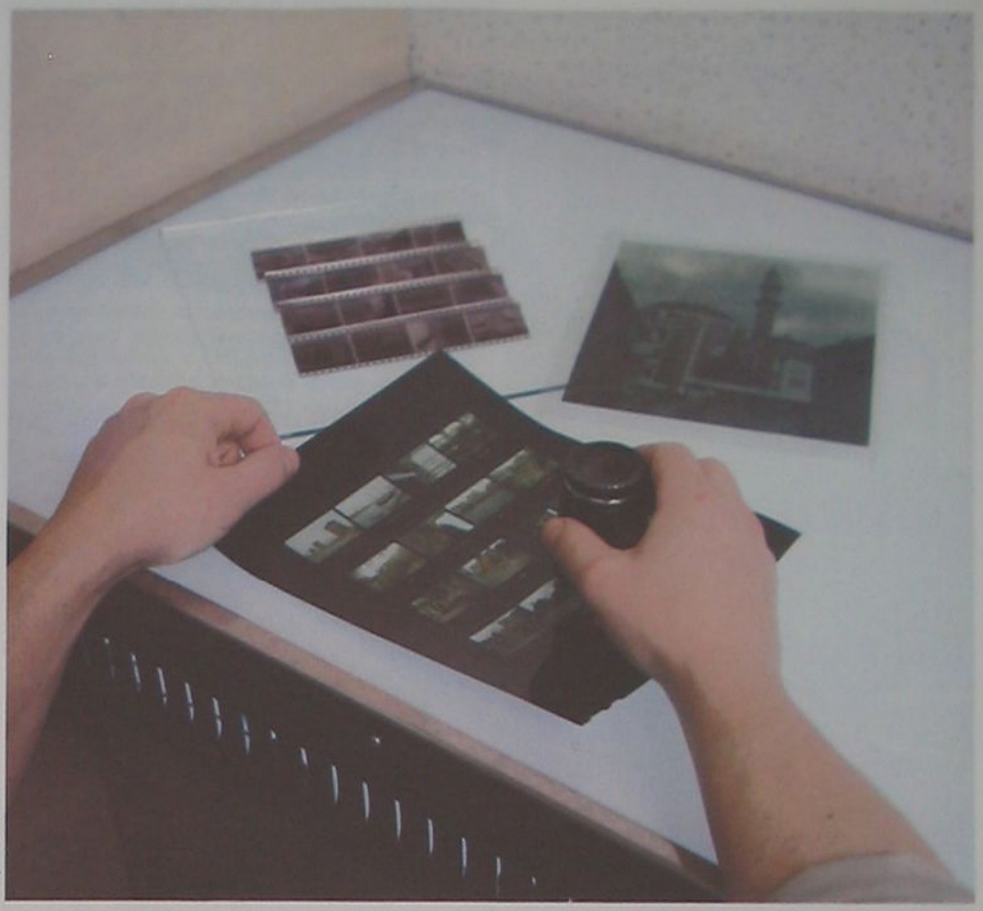
Follow the manufacturer's instructions regarding handling the film by safelight. Store the unexposed film in a cool dry place and do not buy more than you are likely to use in a reasonably short period, certainly no longer than a year. Print film is particularly sensitive to pressure marking, for example by finger nails and kinking.

Printing preparations

You can use any enlarger which produces first class colour paper prints to make print film transparencies. The subtractive printing method allows you to control the colour balance just as when you are making paper prints and all the usual colour filtration rules apply (see pages 590 to 593 and the correction tables here).

It is possible to print by the additive method using a set of tricolour filters. In this case three exposures are made successively through the red, green and blue filters. Colour balance is controlled by varying the exposure times differentially between the three (see page 810).

Dust is a particular problem with all forms of sheet film—no less so when handling print film. Wipe down all work surfaces—including the enlarger easel—



Ray Duns

Slides by contact *A whole length of negative film can be contact printed to make proof slides. The colour printing filtration used for this can be used as a basis for enlargements made from the same roll of film*

with a moist cloth or sponge to remove dust. Let these surfaces dry before beginning work.

Dust is a formidable problem if you want to make 35 mm slides by contact printing 35 mm originals. Antistatic devices may reduce the problem.

If the negatives to be printed have any clear dust specks on them, these should be spotted with opaque before printing, particularly if you are making big enlargements. The resulting light marks on the finished transparency will have to be spotted black, but this is a much more satisfactory way of proceeding than trying to remove black marks on the final result.

Your standard negative

It is a good plan to select a negative taken on the film you normally use, with both white and grey objects appearing in the picture. Print this until you have a transparency you like in which the greys are reproduced as neutrals. This can then become your standard negative and you can use this both for subsequent tests and for further reference. The print filtration can be used to program a colour analyzer.

If an analyzer is not available, place your 'unknown' negatives in a contact frame together with the standard negative. Set the filtration you used previously

Exposing and processing print film

Ray Duns

It is best to handle print film in complete darkness, as you would colour printing paper. If you have a light-coloured enlarging baseboard or easel, it is a good idea to cut a sheet of black paper or thin card to a size which is slightly larger than the print film you are using. Place this under the sheet of print film to prevent light reflecting off the easel or baseboard. To identify the emulsion side, carefully locate the edge which has identifying notch at one end and then turn the sheet until this edge is topmost and the notch is at the right hand end. The emulsion side now faces you. Practice this routine and it becomes almost second nature—and a ploy which can be used for identifying the emulsion side of all forms of sheet film which are notched.

A typical negative should require an exposure of between 10 and 30 seconds for an enlargement of up to × 10—this has to be established by trial and error for your enlarger system. Kodak recommend certain starting filter packs for exposing Kodak colour negative films on to Kodak Vericolor Print Film, with filtration depending on original exposure and enlarger type used. A general starting filtration of 50Y + 50M, quoted for enlargers using dichroic filters with tungsten halogen lamps, changes to 60Y + 75M if colour printing (CC) filters are used in a converted black and white enlarger. The same starting filtration, for Vericolor II type S negatives, is changed to 35Y + 50M in the case of Kodacolor negatives. Additional yellow filtration is recommended for originals exposed under tungsten lighting (60Y + 50M), and even more yellow but less magenta for those exposed under fluorescent lighting (70Y + 30M).

For best tone rendering and colour balance, you should really make a test transparency from each negative. This can, however, be costly and a useful short cut is to make use of contact prints of a number of negatives, exposed at a known constant filtration. These contact prints are readily evaluated and filter changes can be easily made.

Kodak recommend that you process exposed material right away to avoid changes in the latent image. Although you can use dish processing methods, it is far more convenient to use a print drum—but be especially careful when loading and unloading the film as scratches are easily made. Avoid temperature fluctuations when you come to the wash as print film is more delicate than RC paper in this respect. Use a clean film wiper blade to remove surface water before drying.

Print film must be stored at 13°C or lower, safely sealed against moisture, and left to acclimatize properly before use.

Front- or backlit transparencies

Ray Duns, originals courtesy of Kodak Ltd.

Kodak Duratrans is a large size transparency material used exclusively for display purposes and, as such, is available only in rolls of various widths or in a single sheet film size, 40.6 cm × 50.8 cm. It costs about three times the price of conventional colour printing paper, whose characteristics it closely resembles. In fact, it is processed in the same chemicals as ordinary colour paper.

This material's emulsion is coated on to a firm stable white opal plastic base so that when backlit it acts as a transparency —but one which does not require special backing like print film. The opal backing gives Duratrans a special property when the material is lit from the front—it looks just like a normal print. In other respects it is handled and exposed just like ordinary print film.

and expose them all together using your enlarger as a light source. The processed print film will give a good indication of exposure requirements of the different negatives, and a very good guide of the colour correction required in each case.

If you find that the glass of your contact frame introduces a slight yellow or red cast when the contact print of the standard negative is compared to a large size master transparency made through the enlarger, additional filtration is needed to remove the cast. The effect, however, should be equivalent to no more than an 05 or 10 filter, and once the correction is established, simply add this to the standard negative filtration values each time the printer is used.

Judging test prints

You should always view tests using the same light source as will be used to exhibit the finished transparency. 35 mm slides are normally projected using a tungsten lamp, so when assessing them use a high efficiency tungsten lamp. For larger sized transparencies, either buy or make a lightbox which has fluorescent tubes. The tubes should be of the colour matching type, or ones specifically designed for transparency viewing such as those simulating a 5000K colour temperature. The makers of the tubes will give advice about this on request.

Mask the test so that bright light round the edges does not spoil your judgement when you assess the density and colour balance. If the subject contains any neutrals be sure to include these on a test strip from a big enlargement. It is a good idea to have a small piece of fogged and processed black and white film available on the light box. This will enable you to 'key' your eye to a true neutral for comparison with greys as reproduced in print film tests. In some cases it may be useful to isolate the two areas with pieces of black paper with holes in them, as surrounding colours can upset your judgement as to what is really a 'true' grey.

If it is clear from your tests that an unknown negative requires some increase or decrease in exposure, vary the intensity of light reaching the baseboard by opening or stopping down the enlarger lens rather than by adjusting the timer itself.

Processing print film

Whichever make of print film you choose, when it comes to processing, follow the maker's instructions precisely. Keep to the recommended processes, times and temperatures.

Because of the delicate nature of print film, drum processing is preferable to dish processing. Use a waterbath for temperature control as solutions must be maintained at a fairly constant temperature to prevent reticulation. Provide wash water which is at the correct process temperature. If you like, use any surplus from the waterbath—providing it is clean—for the first rinse, gradually introducing cooler tap water for the start of the wash period proper. After processing is complete hang the film up to dry in a dust-free area.

Finishing and presentation

In the case of a 35 mm slide, all that then remains is to trim the contact print and mount it. Larger transparencies should be spotted carefully on a lightbox. This is easier if you use a piece of black card with a frame-sized aperture cut out of the middle. In this way defects show up more clearly and there is less eye strain than when light from the retouching box is flooding up into your eyes.

As with prints, a No 3 sable brush with a fine point used reasonably dry will give the best result. Use dyes that are designed for transparencies as these are reasonably stable, and should show correctly if the result is reproduced in any way. Normally three colours—cyan, magenta and yellow—are adequate, with a good neutral black to increase density. Blemishes which are black or coloured can sometimes be removed with bleach but this treatment may leave a stain.

When retouched, the transparency is ready to be mounted. The normal method for display purposes is to bind it between clear glass or acrylic sheet (plexi-glass) with a diffuser behind. The diffuser can be flashed opal glass, which is very expensive, or white acrylic. Bind the sandwich together with strong tape. The slide can then be placed on a suitable display light box which you can buy or make yourself.

If you are simply showing large size transparencies by hand, mount the print film in commercially available plastic viewing sleeves. These are clear on one side and frosted on the other. As these can be too flexible for some purposes an alternative is to have the film laminated between sheets of plastic. Some processing firms offer this service for about the price of a colour slide film.

Courtesy of Kodak Ltd.

The world's largest *Measuring slightly more than 18 m × 5 m, this print film transparency displayed in New York's Grand Central Station is the ultimate advertisement for the material*

Working with studio flash

Although similar in principle to their portable counterparts, studio flash units demand more care and skill in use but, in return, offer much greater versatility, and considerably more power

Electronic flash has clear advantages as a light source, both on location and in the studio. Its colour is balanced for use with transparency film, and the duration of the flash is brief enough to freeze all but the fastest action.

Studio flash units, however, are not quite as simple to operate as the small, hot shoe mounted guns that are frequently used with 35 mm cameras. They are much more powerful, and are always manually operated, so the direction, quality and intensity of the light they produce is completely under the control of the photographer.

For the occasional user of studio electronic flash, however, learning how to get the best results is the second problem—actually finding out how to use the units at all is the first.

Studio flash is actually easy to use though the controls and operation may seem rather daunting initially. First, plug the flash in and switch on at the mains supply and at the unit itself. Once the capacitors are fully charged, the modelling light should come on. The synchronization lead plugs into the camera in the same way as the flashgun, but at the other end there is a large jack-plug which must be plugged into a socket on the flashpack.

Once you have connected the camera and flash with the sync cable, you can proceed in much the same way as you would with a hand-held unit.

If you are familiar with a low power hand flashgun, the fast recycling may come as a pleasant change—often, the flash recycles as quickly as you can wind on. The high power of studio flash is a great asset, too—with 100 ASA film, you are likely to be working at an aperture of *f*/8 or smaller, though this also depends on the size of reflector you use.

Victor Watts

In a tangle *Although studio flash may initially seem complex, a systematic approach can soon sort things out*

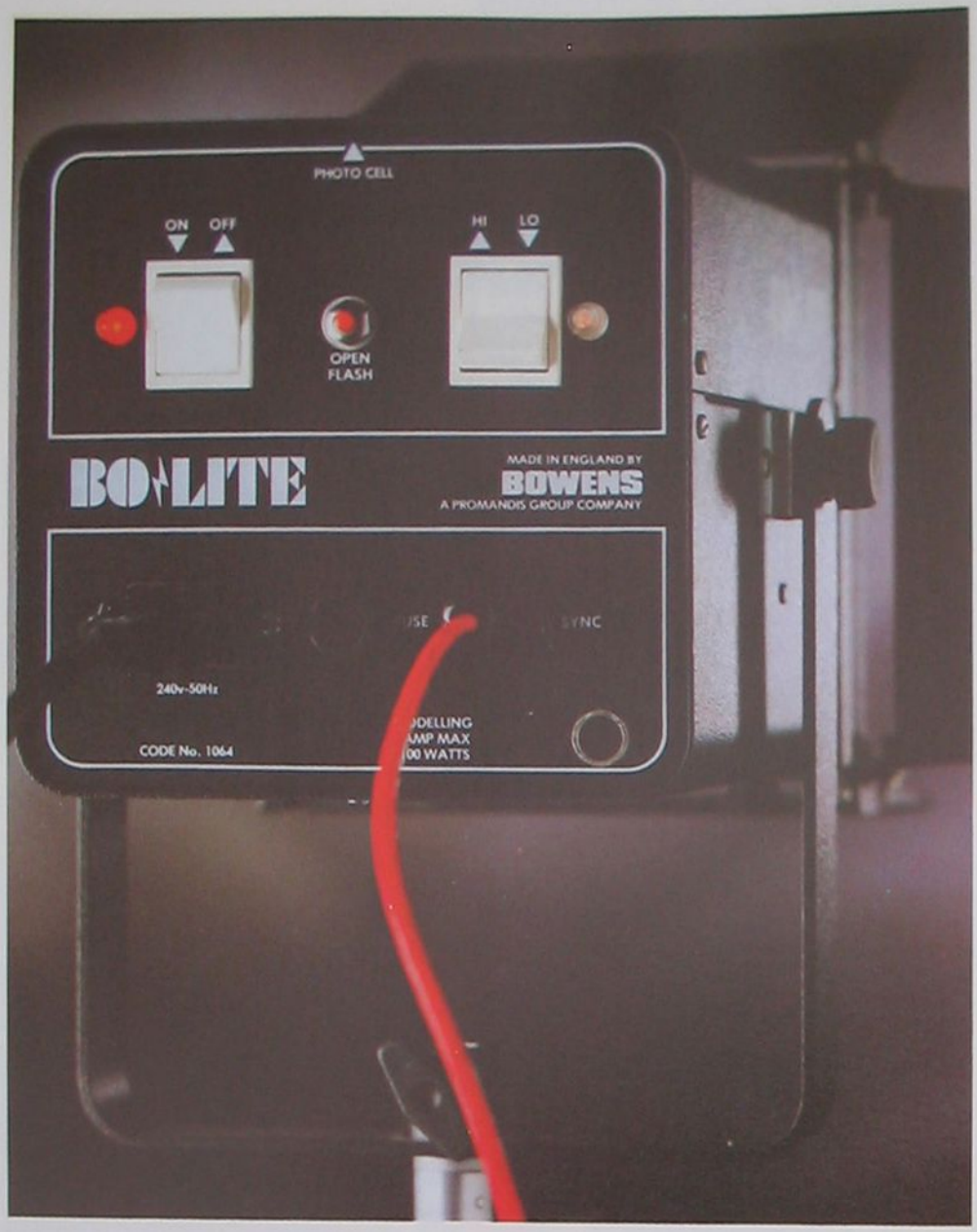
Controlling the light

One of the major advantages of studio flash units is that they can be used with a wide range of reflectors and accessories. You can change the reflector to give the right type of light for every subject. The simplest reflectors are just shiny metal dishes, and these come in a range of sizes. Generally, the smaller they are the harsher and more contrasty is the light they produce.

For a softer effect, use a larger reflector, with a white surface on the inside. Some of these white dishes have a cap to prevent light from the flash tube reaching the subject directly. This softens the light even further but still retains quite definite modelling.

A very popular way of using flash is to bounce it off the interior of a silver or white fabric umbrella. These behave as giant size reflectors, but they are light in weight and can be folded up like an umbrella for transport.

The large reflective surface of an umbrella gives a very soft light which is ideal for portraiture. Silver umbrellas give a slightly harsher, more contrasty light that looks good on black and white film, while white umbrellas produce softer, more gentle results. But the softest results of all are produced by white nylon umbrellas. With this type of umbrella, the flash is fired through the



Victor Watts

material instead of being bounced off it and so it acts like a giant diffuser.

Professional studios go in for even bigger diffused light sources, which are often referred to as *fish friers* or, the larger sizes, *swimming pools*. These produce extremely soft lighting, and for lighting shiny objects, for example, which reflect the shape of the light source clearly, they are ideal. Here, the rectangular shape of the fish frier scores over the octagonal outline of the umbrella.

Changing the reflector is not the only way of controlling the light from the flash. By bouncing the light off the ceiling, or by sending it through sheets of diffusing material, you can further modify how it falls on the subject. You can control its colour with acrylic lighting gels, which can be placed in front of the reflector—double ended spring clips are useful for this—and you can shade parts of the subject using barn doors.

Obviously, the effect of the light varies considerably with its position and you should experiment using the modelling light to find the best position.

Light control *A Hi/Lo switch controls power output, and reflectors can be changed for softer or harsher lighting. Below, fitting a white umbrella*

Victor Watts

Controlling the power

The size and shape of the reflector that you use has a direct effect on how efficiently the power of the flash is used. Small, silver reflectors concentrate the light and make the fullest use of it. Large white ones dissipate power, forcing you to use a wider aperture. Umbrellas, particularly white ones, soak up light, reducing the output of the unit by up to three stops.

This is the reason why professional flash units are so high powered and have considerable power in reserve. Smaller units which are less powerful may present problems when used with umbrellas, and you may find yourself working at an unacceptably wide aperture.

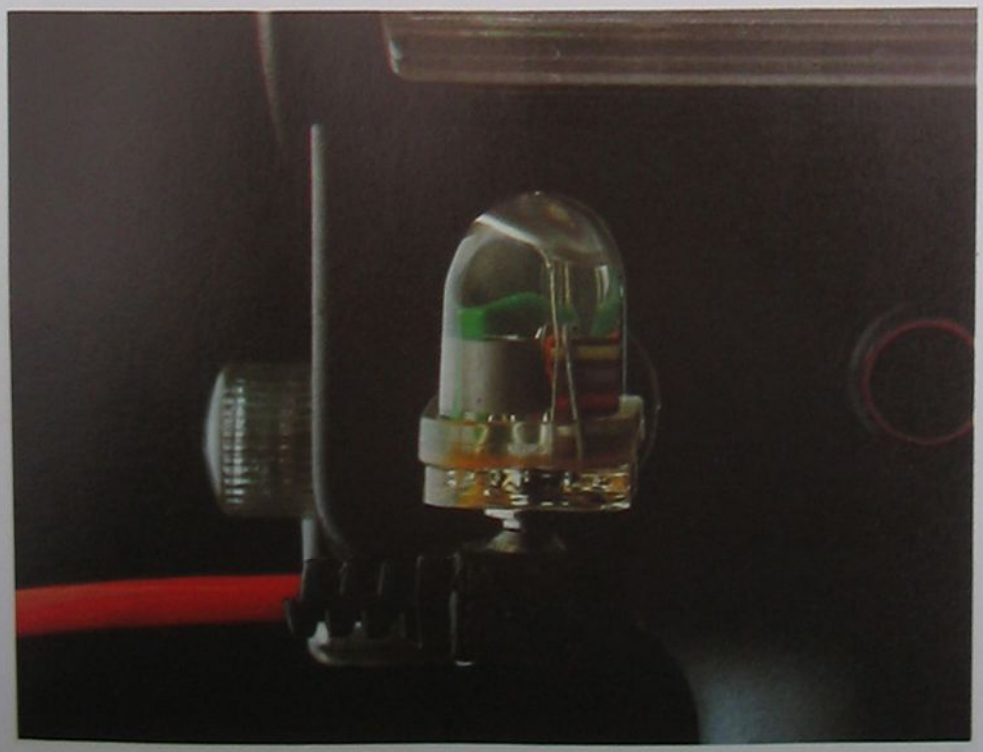
A solution to this problem is to move the lights in towards the subject—large reflectors and umbrellas can be moved in much closer than small ones—or to use faster film. Another solution, which is popular with still life photographers, is to completely black out the studio, and fire the flash several times with the camera's shutter locked open. Obviously this only works with a static subject.

At the other end of the scale, you may find yourself with too much power. All but the smallest units have a power reduction switch, for this very reason. They can be turned down to $\frac{1}{2}$, $\frac{1}{4}$, or even $\frac{1}{8}$ power, and if you are working at very close range, you may need to take advantage of this facility to enable you to work at a reasonable aperture. For example, when the flash head is only a metre from the subject, and set to full power, you may need to use an aperture of *f*/32 or *f*/45 on 100 ASA film. With small format cameras, this is out of the question, and reducing the power is the only practical alternative.

If the power of the flash is not switchable, it is a simple matter to use grey neutral density lighting gels to cut down on the output, and these are also useful with switchable units should the $\frac{1}{2}$ or $\frac{1}{4}$ power setting still prove too bright.

Victor Watts

Checking exposure *When using flash, it is often difficult to judge whether the subject is evenly illuminated, so it is important to take flashmeter readings both at the centre, and at the edges of the picture area*



Slave sync *Cordless flash triggering is possible using a plug-in slave cell on a general purpose unit such as this*

Switching to a lower power setting usually alters the modelling lights too. These are dimmed in proportion to the flash tube so that you can get some idea of the balance of light between two or more flash heads. To get a true picture of the relationship between the power of several lights, all other sources of light must be blacked out, particularly if any of the units are operating on low power settings.

Modelling lights, even proportionally dimmed ones, cannot give any indication of the brightness of the flash in relation to ambient lighting. Only an actual exposure on either conventional or Polaroid film can do this.

Controlling exposure

With a small hot shoe flash, determining exposure is a simple matter, but with large studio units, the situation is more complicated. The only satisfactory way of setting the right aperture on the camera is to use a flash exposure meter. This looks similar to a conventional incident light exposure meter, but has no scale of shutter speeds—only film speeds and apertures. Its internal workings, however, are quite different, and it is only sensitive to the sudden surge of illumination produced by the electronic flash unit. Ambient light has no effect on the flashmeter reading.

To take a flash exposure reading, the meter is placed as close as possible to the subject, with its white domed diffuser pointing at the camera. The flash is then fired, either using a cable linking the meter and the flashpack, or—with meters that can be used in the cordless mode—by pressing the open flash button on the flashpack. A display on the meter then indicates the aperture to be used, either directly with a digital readout, or indirectly, using a needle and a calculator dial. Some models of meter can be used to accumulate readings, so that repeated firings of the flash either move the needle up the scale or light different LEDs.

When using a flashmeter, remember that it can be used to check the ratio between shadows and highlights of the picture, so that you can make sure that the film is capable of accommodating the full tonal range of the subject. You can also use it to check the fall-off of illumination, and this is particularly important if you are lighting a large set, or if you have placed most of your flash heads high up above the subject. With a full-length portrait, for example, you should take readings at both face and floor level; there may be a fall-off of one or two stops which you can remedy either by moving lights or adding reflectors.

In addition to a flashmeter reading, many professionals like to take a picture on instant film to check the lighting. All large format cameras can accommodate instant film backs, and most roll film

cameras can be fitted with a special Polaroid back. A New York company even adapts 35 mm camera backs for use with Polaroid film.

An instant picture allows you to assess the degree of contrast that will appear on film, and lets you balance flash and daylight. But neither Polaroid test shots nor flashmeter readings guarantee that exposure will be exactly right. To be absolutely sure of getting the pictures you want, you must bracket a series of exposures—at half stop intervals for transparency film, and full stops for negatives—or else run a *clip test*. This is a facility offered by professional labs, and consists of snipping off the first few frames of a film, processing them and asessing them for exposure, and pushing or pulling the rest of the film so that the density is exactly right. The asessment can be done either by the photographer or the lab.

The advantages of this system are that it avoids the frustration of finding that the best picture from your portrait session is one stop underexposed. On the other hand, there is an extra charge for a clip-test, not all labs run them, and you have to wait longer for your film.

Check everything

Working with studio flash can seem difficult if you are not used to it, but after a while you will find it is as simple as working with tungsten light. Photographers who are constantly in the studio often develop an ability to estimate flash exposure very accurately, just by glancing at the power output of each flash head, though such skill comes only with years of practice. There are, however, a few of the professionals' habits worth adopting.

First of all, check everything—twice. It is very easy to do a session without noticing that there is something fundamentally wrong. Do not forget that cameras with focal plane shutters must be used at slow speeds if they are to synchronize with the flash. It is easy to inadvertently move the shutter dial.

Think of safety first. Do not leave a camera on a table with the sync cable trailing across the floor, because someone is bound to walk past, catch the cable with their foot, and send the camera crashing to the ground. The same is true of the flash heads, particularly the monobloc units which are top-heavy. If there are a number of cables snaking round the studio floor, tape them down so that they do not pose such a safety risk.

Remember that electronic flash generates very high voltages, so never touch anything with wet hands, and do not try to repair faulty units yourself. Take special care with older units. Some of them must be unplugged from the mains before changing the flash head configuration. Failure to do this can result in a fatal electric shock!

Check all the synchronization cables. If you are using more than one flash head, use a cable to synchronize the first, with slave cells to fire the others. Slaves plug into the jack socket that usually takes the sync cable. Some photographers use slave cells on every head, and fire them with a low power flash on the camera.

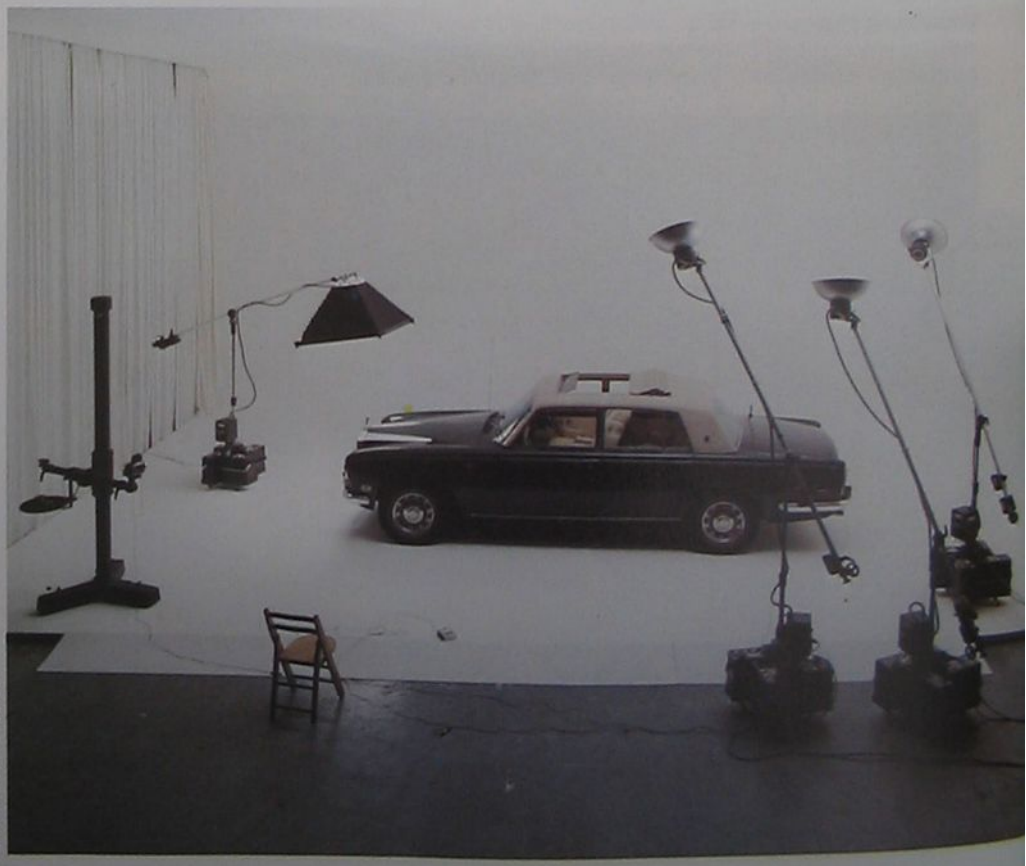
Victor Watts

Exposure control *A flashmeter and Polaroid film help gauge exposure, and a clip test makes fine tuning possible*

Check the readylights. With multiple flash set-ups, these should all go out after the exposure has been made. If they do not, check the sync cables again, or turn the slave triggers to point at the main flash. If your system can be switched so that the modelling lights go out after each exposure, use this facility to check that every head is firing. The modelling lights come back on after the pack has recycled, and this is a reliable indication that it is safe to make another exposure. With other units, keep your eye on the readylight—it is easy to get carried away and try to work too fast.

Finally, a tip about bracketing. If you can, bracket the pictures using the power output of the flash, and not the lens aperture. This way, depth of field will be the same in all pictures.

High power flash *A large studio needs lots of light. This one is equipped with a system 1000 times more powerful than the average hot shoe flashgun*



Link House Studios

What went wrong?

Outdoor portraits-2

Pictures taken outdoors—particularly portraits—are often taken on impulse, and, consequently, suffer. But thinking before you shoot may prevent disappointment

In overcast conditions shadows tend to photograph much darker than they seem in real life. A portrait taken under an umbrella only aggravates the problem (far left). You could give a stop or more extra exposure but this will lead to over-exposure of all surrounding detail. A vast improvement (centre) can be made simply by using a reflector (right)

Fill-in flash can be used to liven up shots taken on overcast days (near left). Without it, results look murky and colourless (far left). But be careful to match the flash output (or adjust the flash–subject distance) so that the daylight exposure aperture matches that used for the fill-in flash exposure, or flash becomes obvious (centre)

Two attempts at the same shot. On a dull day, it is hard to keep everything sharp. This shot manages it, but the subjects are rather distant

A closer shot is more interesting, but the depth of field is now limited. The only solution is to use a longer exposure time and a tripod

Avoid this common problem of 'growths' from the head by doing a focus check past your subject and on to infinity to look for distractions, like trees

Assignment

Still life

In still life photography pressing the shutter is simply the climax of a long and involved procedure. In this assignment, Jason Shenai demonstrates the patience and the work that is needed

All of us have seen enticing advertisements showing beautifully lit glassware or bottles of spirits. But for most people interested in photography, the techniques involved in this type of still life remain a mystery. To find out how a professional goes about tackling an assignment like this, we asked Jason Shenai to arrange a simple shot which would demonstrate what is involved.

Jason decided to shoot an arrangement of three delicate glasses and to make use of the light transmitting qualities of glass. While setting up the shot he explained, 'I always feel that glass objects should be lit from below and behind to avoid having bright reflections on the glass.' For this reason he positioned the glasses on a three-metre length of translucent plastic, curving the rear of it upwards and attaching it to a bracket on the ceiling. With a single flash head positioned underneath this surface, the arrangement was adjusted so that the light travelled straight up through the glassware. To achieve maximum power, and so also, maximum depth of field, Jason coupled the single Bowens 4000 Quad flash head to two Bowen Quad 2002 studio flash packs.

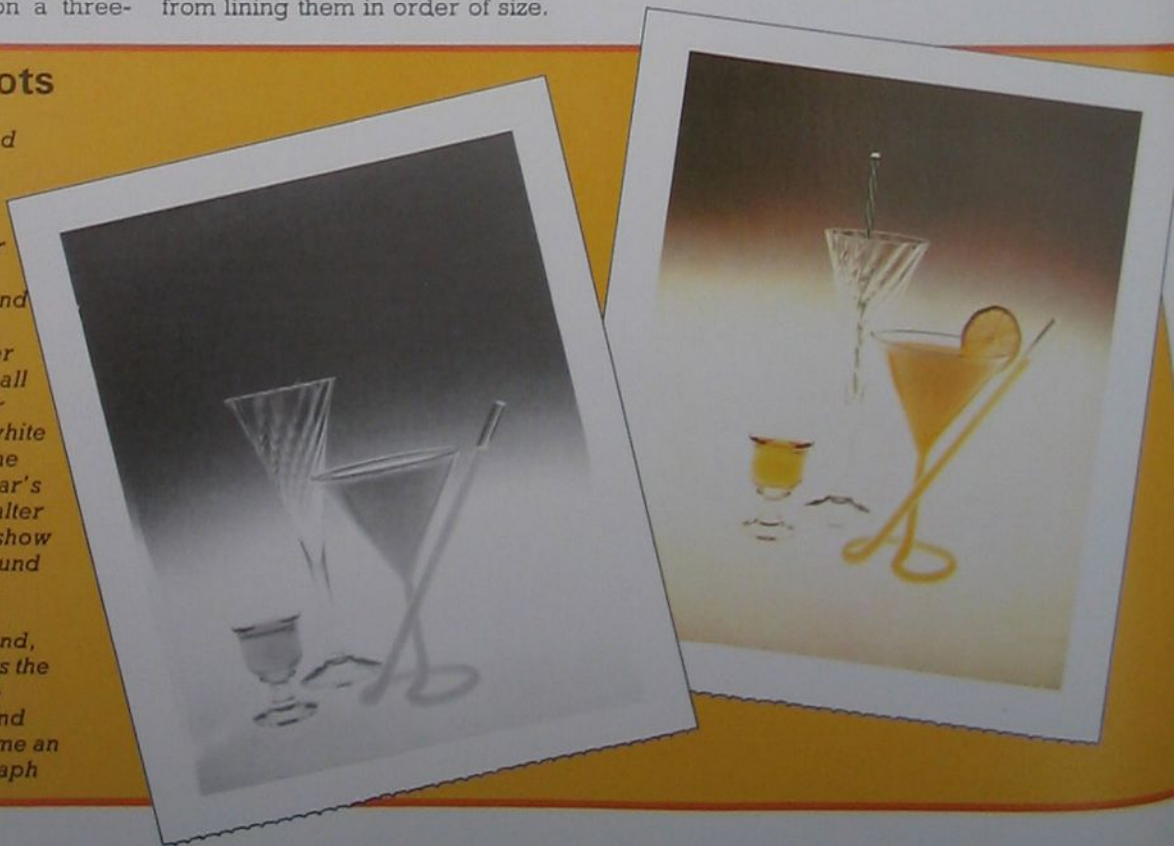
Keeping the composition simple and uncluttered was always in Jason's mind as he arranged the glasses. Since he had chosen sizes, he was careful to position them in a balanced way—avoiding the sharp diagonal which would result from lining them in order of size.

Jason feels that keeping this set-up simple is one of the ways of approaching any type of glass object. The flash head, with its modelling light switched on, was positioned at an angle of about 45° towards the camera. Then the barn doors were adjusted to block light from both the background and the foreground areas. This, combined with slight adjustments to the angle of the flash head, enabled the reflections to be pronounced in the front of the glasses while allowing the background to darken as it receded from the camera.

All this sounds very methodical and straightforward, but in fact, there is a large amount of trial and error involved in making sure that all such adjustments

Polaroid test shots

These Polaroid shots allowed Jason to monitor each stage of the procedure towards the final image. The first one (left) shows the need for a slight shift in the overall composition and in the second Jason found the shot looked better with the stirrer and lemon slice added. Not all of them were done in colour simply because black and white film is far less expensive. The final shots show how the Sinar's movements can be used to alter the perspective. They also show how the strength of foreground reflections are determined. Since this area was lit only by light reflected from behind, the height of the camera was the main device for altering the strength of the reflections and for ensuring that they became an integral part of the photograph



have the desired effect. This is where a camera with a Polaroid back shows its advantages and is just one reason why Jason uses a 5 × 4 inch Sinar camera for all his commercial assignments: 'It offers superb resolution and depth of field and also makes large and extremely clear Polaroids. The format is ideal for magazine work since I can tell exactly where to leave space for typography. But one of the most useful features of a technical camera like this is that its moveable back and front standards allow you to focus extremely accurately and correct perspective.'

The Polaroids are useful for checking the exposure settings. With large format film being so expensive, few photographers can afford the luxury of bracketing exposures. Using Ektachrome EPR 64 ASA/ISO transparency film, Jason used a flash meter to determine the right aperture—f/45.

However, Polaroids have another use. Much of the time involved in a shot of this sort is spent on small details which can be instantly checked using Polaroid test shots. Interpreting these shots, Jason was to alter the camera height to strengthen the foreground reflections, to pronounce the ball of light on the end of the stirrer and to produce just the right colour and intensity in the liquids—he spent half an hour devising a way of diluting the orange juice in the glass for a transluscent effect while retaining the colour of pure juice in the stem. After scrutinising the Polaroids, Jason also decided to adjust the arrangement of the glasses and spent nearly an hour making small changes to their positions. At the end of the session he explained, 'It might appear that I am unnecessarily fussy, but a still life shot must be a good picture in its own right, as well as an accurate representation of the subject.'

Jason Shenai

Here, the background is too dark. Jason adjusted the barn doors to reduce the intensity in the final shot
The movements of the Sinar allowed the angle of view to be altered —avoiding shooting down into the glasses
Jason was unhappy about the colour of the liquid in the small glass, so he replaced the whisky with cold tea
To make the orange juice more translucent, the liquid was diluted—except in the stem where a stronger colour was needed
Jason also felt that the reflections were too weak, so he adjusted the light and the height of the camera to make them look more prominent

Caroline Calif

Improve your technique

Using infrared film

In the camera of a creative photographer, infrared film unlocks the door of an amazing dream world where colours and tones are distorted and unreal

One of the most popular of all specialist films is infrared film. With its extra sensitivity to invisible infrared 'light', it has many scientific and technical uses, while its unusual colour and tone rendering give the creative photographer tremendous scope. It is very simple to use and calls for little special equipment—it can be loaded into an ordinary SLR—but to get the best from infrared, whether for creative or technical work, you must follow a number of simple rules.

Infrared film is marketed by Kodak in black and white and colour slide versions and is available at many large photographic dealers. Both black and white and colour versions are similar in that they are sensitive to both infrared and visible light and in certain instances results on either can look similar to those on normal film. Nevertheless, each must be handled in a particular way because of their unique qualities.

Colour infrared

Ektachrome infrared, the colour infrared film, is sold in ordinary 35 mm film cassettes and can be loaded and unloaded in subdued light in the same way as normal colour film. However, it must be stored in a freezer (but allowed time to warm up before use) and processed immediately after exposure. Poorly stored, the emulsion layers in the film age differently and the colour balance becomes biased towards cyan. Though you may be able to use this colour shift creatively, it is usually undesirable.

Like normal colour film, Ektachrome infrared has three emulsion layers each sensitive to a different colour (see page 578), but unlike conventional film, no

Infrared outdoors *For the creative photographer, colour IR film offers a completely new pallet. With appropriate filtration, foliage appears as bright red, and water as purple or black*

Carol Jopp/Robert Harding Associates

attempt is made to reproduce lifelike colours in the transparency. Green light forms a blue image, for example, and red light, a yellow one.

However, whenever there is any infrared present, as there is in most scenes, colours in the photograph begin to look much stranger. The film is particularly sensitive to the infrared reflected by healthy foliage—infrared film was originally designed to show up camouflage in World War 2—and foliage reproduces as bright red or magenta. Even the extra infrared reflected by blood makes veins just under the skin show up as brown lines in the slide.

Any blue in the subject will also distort colours and for technical pictures in daylight, where the aim is normally to show up areas of infrared reflection, you should put a Wratten 12 yellow filter on the camera to cut out the blue. For creative pictures, of course, this is not so important, but results are generally more attractive if you use a yellow filter. In tungsten lighting, for correct colour balance—that is, the balance the film is designed to give, which is by no means normal—you should use a CC 50 cyan filter as well.

When you are deliberately trying to introduce weird colours, you can experiment with any coloured filter on the camera to produce the desired effect—though the results are generally difficult to predict. For example, a yellow Wratten 8 filter produces a bluer cast to

Christopher Cormack

Misty woods *With infrared film, a special focusing adjustment must be made, or pictures will be unsharp*

vegetation, a Wratten 21 a more orange cast, while a 25 red, among other things, usually gives a yellow sky.

Exposure for infrared film is not as simple as it is for conventional emulsions, simply because exposure meters are specifically designed to be sensitive only to the visible part of the spectrum. However, the amount of infrared radiation present out doors on any day is generally proportional to the level of visible light—when the sun shines, both infrared and visible light get brighter. So you can generally use the meter reading as a basis for calculating exposure. But since colour infrared is rated to include the reduction in light produced by the Wratten 12 yellow filter, a TTL meter reading with the filter in place indicates the wrong exposure. To estimate the correct exposure with a TTL meter set the film speed to 100 ASA (ISO), and take readings without a filter on the lens.

Readings taken on this basis should be appropriate for pictures taken through a Wratten 12 yellow filter, but with other filters, you need to give extra exposure. Filter factors are hard to

estimate, because the characteristics of the filter may affect the infrared sensitive layer to a greater or lesser extent than the other layers. The only way to be certain of perfect exposure is to bracket the pictures at half or one stop intervals, for two stops on either side of the indicated exposure.

Ektachrome Infrared is processed by the obsolescent E4 system, which has been largely phased out. A few laboratories still process E4 films however, and you should contact Kodak for the address of your nearest lab.

Black and white

Kodak's infrared sensitive black and white film is called *High Speed Infrared*, and is available in 20 exposure cassettes of 35 mm film, and also as sheet film.

Like Ektachrome Infrared, it is sensitive to visible light as well as infrared, and when used with red filtration, it sometimes produces pictures which look fairly similar to those taken on ordinary black and white film.

However, High Speed Infrared is much more sensitive to infrared than Ektachrome and its extreme sensitivity means that it must be handled with great care. It is very susceptible to fogging by ambient infrared, and it must be loaded into the camera and unloaded in total darkness. The velvet light trap of the 35 mm cassette is transparent to infrared, and in direct sunlight, even the fabric of a changing bag may not prevent fogging. Load your camera in the darkroom before going out to take pictures, and if you have to reload during a session, do so with the camera and film in a changing bag in deep shade—ideally indoors.

Even your camera may be slightly transparent to infrared radiation, particularly any plastic components. Rangefinder cameras which have fabric focal plane shutters are especially susceptible to fogging of the film. Fortunately, in an SLR the infrared radiation is directed upwards by the reflex mirror, and the shutter is only exposed to infrared in the instant before it opens to take the picture.

If you want to use High Speed Infrared simply for its ability to penetrate mist (see page 1146), you must always use a filter to give correct tones, just as with Ektachrome Infrared. The most commonly used filters are Wratten 25 (red), 15 (orange), and 29 or 70 (both deep red). All these allow some visible light to pass, and tones in the final picture are little different from those in the subject.

Because of its extended infrared sensitivity, however, black and white infrared can be used with a visually opaque filter—such as Wratten filters 87, 87C or 88A. These give very strange results—foliage comes out white, and a blue sky is recorded as solid black.

Just as for colour infrared, it can be hard to achieve correct exposure. If you are using a 25 red filter, set your meter to 50 ASA to provide a starting point for calculations for a daylight shot. In tungsten light, set the dial for 125 ASA. A Wratten 87 filter requires more light, and outdoors an exposure of ASA 25 is more appropriate—set ASA 64 in tungsten light. If you have an SLR with a TTL meter, take readings with the filter removed, as with Ektachrome infrared, or else use a separate, hand-held meter.

Focusing

As infrared wavelengths are longer than visible ones, they are refracted differently by the glass of your lens. As a result, an infrared image normally comes to a focus at a point slightly behind the film plane, when the camera is focused for visible light. This complicates focusing, and if you are forming an image using purely infrared radiation, you must make an adjustment to take this into account.

Most lenses have a red dot on the fixed part of the focusing scale to act as a new focusing index for infrared light. Use this by focusing the image normally, then noting the subject distance on the moving part of the scale. Then shift the focusing ring until this subject distance is aligned with the infrared focusing mark on the lens barrel.

If your lens does not have a special infrared index, it is still easy to focus for infrared light. Focus the camera normally, and then turn the focusing ring as if to focus on a closer object. Keep turning until the subject distance is aligned with the depth of field mark for *f*/5.6. If you use infrared film frequently, you may wish to put a small mark on the scale at this point—a scratch or a spot of paint.

These special focusing techniques apply only to photography using infrared radiation alone—that is, if you are using a visually opaque filter. Other filters allow at least some visible light to pass through to the film, so the image is formed by a broad range of wavelengths. No ordinary lens can bring all these wavelengths to the same focus, so no one focus setting is appropriate for both visible light and infrared. The only way to cope with this problem is to set the focusing ring to a position halfway between the infrared index and the ordinary focusing index, and then stop down the lens to *f*/8 or smaller.

Processing and printing

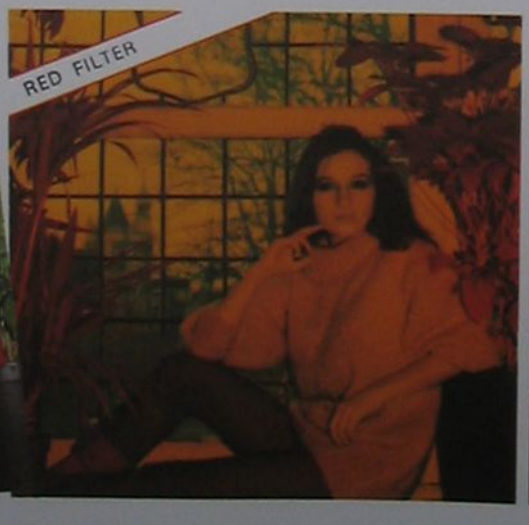
Process High Speed Infrared film as quickly as possible after exposure, and if you are doing it yourself, treat the film gently, as the emulsion is comparitively delicate. Stainless steel tanks reduce the risk of fogging to a minimum, though if you do your processing in subdued light, even a plastic tank should prove adequate—run a quick test before you risk an important film, though.

Kodak recommend the use of D-76, D-19 or Microdol-X developers, with processing times of 10 minutes for undiluted D-76, 8 minutes for D-19, and 13 minutes for Microdol-X, all at 20°C with five seconds agitation every minute. If you do not normally use a Kodak developer, your normal black and white developer should be adequate but give 50 to a 100 per cent extra time.

When printing infrared negatives, you may find that a long exposure is necessary, because they are usually denser than panchromatic negatives. The graininess is worse, too, particularly if the film has been overexposed, and the maximum size of print possible from a 35 mm negative is about 20 x 30 cm. Prints larger than this will have very prominent grain.

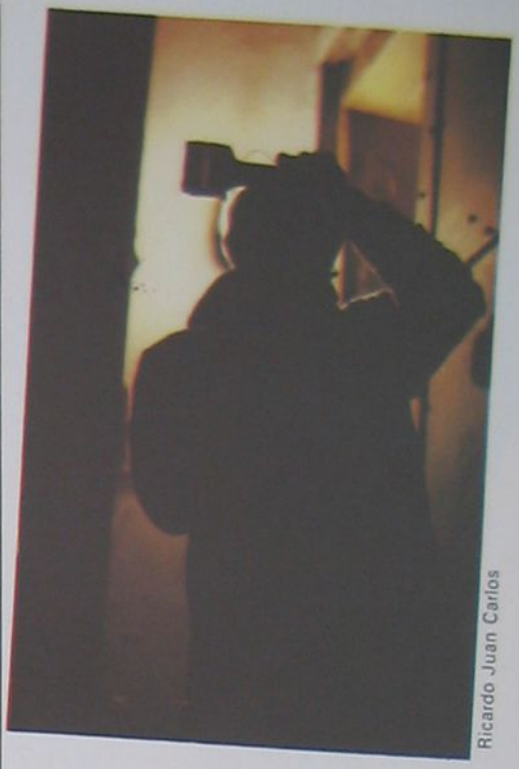
When printing a particularly dense negative, take care that the edges of the negative do not allow light to flood on to the image area and fog the print. If your enlarger does not have sliding masks below the negative, mask off the clear rebate with red lith tape.

Kim Sayer



David Hoffman

Robinson/Brown



Ricardo Juan Carlos

Dark deeds *You can take shots undetected in complete darkness with IR film and an 87 filter over the flash. This cuts out visible light but lets IR through. If the unwitting subjects look directly at the flash they see only a very dim red glow*

Invisible pictures

Because infrared radiation is normally invisible, it is possible to use it to illuminate a scene and take a photograph on infrared film, without anybody in front of the camera being aware of the light. This technique is often used by police authorities and surveillance agencies, who use it to photograph suspects at night without their knowledge.

WARNING
Do not be tempted to look at the sun through a visually opaque filter. Although you will not see anything through the filter, harmful infrared radiation passes straight through, and this can quickly damage your eyesight.

Because this technique uses only the infrared sensitivity of the film, it works only with black and white infrared film. On Ektachrome Infrared, it exposes only the cyan-forming layer of the film, and therefore produces just a red image.

Suitable sources of infrared radiation are flashbulbs, floodlights or electronic flash, all of which must be filtered to make sure that they do not emit any visible light. The most practical source of infrared light is a portable electronic flash unit with a Wratten 87 filter over the reflector. The filter makes the flash invisible, except to someone who is looking directly at the reflector, and even they see only a dull red glow.

The filter on the flash cuts the output of your flashgun to about a third of its normal value, and unless you have quite a powerful unit, it may be all but useless with infrared film. As a starting point for exposure settings, you should use the normal guide number for your film, then open up the lens aperture by 1½ stops. You should regard this only as a general guide, and you will have to experiment to determine an accurate guide number for your particular flashgun.

Changing filters *IR Ektachrome does not respond to filtration in the normal way—a yellow filter over the lens, for example, removes a yellow cast when you would expect it to create one*

Large format cameras

Outstanding image quality and a high degree of control over composition—if you need these features, then a large format camera may suit you

Dave King/equipment courtesy of Sinar (Laptech)

Modular concept *From lens panels and focusing screens to polaroid backs and extension rails, the basic monorail (top) accepts a range of components*

The term 'large format' is often used for any camera with a negative larger than 35 mm. Strictly speaking, though, it only applies to certain types of camera which give very large negatives, usually 5 × 4 inches but sometimes much larger. Though made primarily for professional use, they have some unique features which make them worth considering by any enthusiast.

Most large format cameras are bulky, heavy and slow to use. They do not have eye level reflex viewing or quick, easy focusing, and usually have to be supported on a tripod. They can also prove expensive to run, and a single transparency can cost as much as a whole roll of 35 mm film.

Nevertheless, their large negatives give far better image quality than smaller formats, and their construction gives great control over the image. If these are your primary considerations, then one of these cameras may suit your purpose.

Advantages of large format

The more you enlarge a negative, the more quality you inevitably lose. The great advantage of large negatives is that they do not need to be enlarged so much—image quality is therefore superior to all other formats. It is easy, also, to print a small part of the negative and still retain good quality, so precise framing is less important—the image can be cropped at the printing stage.

Processing is less critical than with smaller negatives, and films can be 'pushed' without undue harm to image quality—even dirt and fingerprints are tolerable. Conversely, with correct processing quality is superb and results can be impressive. Retouching is also easier than with smaller formats.

As well as a large negative size, large format cameras offer great versatility. With the long bellows extension they provide, the subject can be reproduced life size on the film even with a standard lens. Perspective and depth of field can be controlled in ways impossible with any other type of camera, by moving the rear or the front standard (see page 778). As well as the to-and-fro movement of focusing, vertical, horizontal and angular displacements are possible, and even the shape of the final image can be controlled: subjects can be made to look longer, for instance, without the exaggerated perspective of a wide angle lens.

Large format cameras are also extremely reliable, because they do not have to be light and compact, and can therefore be very sturdily built. Very often, old models in perfect working order can be bought, and many photographers (Ken Griffiths, for example—see page 1168) work regularly with one of these as their standard camera.

Range of formats *You can use the same camera with various film sizes by fitting different holders. Shown is a 5 × 4 inch film holder, and 5 × 4, 10 × 8 and 11 × 14 film sheets. A 35 mm slide gives some idea of the image size*

Negative sizes

The commonest negative size is 5 × 4 inches, and this is a fairly standard professional format. A metric version, 9 × 12 cm, is also available. The film holders for 5 × 4 inch and 9 × 12 cm often have the same external dimensions, so they may be used interchangeably. The same applies to some other film sizes.

Both roll film and cut film are available, in a fairly wide range. Other formats can be found too—the smallest is 2¼ × 3¼ inch, next comes 3¼ × 4¼ inch (quarter plate), then 4¾ × 6½ (half plate), 5 × 7, (equivalent to 13 × 18 cm) and 6½ × 8½ inch (whole plate). The really large formats are 10 × 8 inches (equivalent to 18 × 24 cm), 11 × 14 inches and 12 × 20 inches, known as 'banquet'.

Apart from 5 × 4 inch, most professional photographers use 5 × 7 or 10 × 8 inch formats. The choice of films for the 'plate' sizes is rather restricted and film manufacturers seem to be slowly phasing them out.

Types of camera

Large format cameras consist of a front standard and a rear standard, connected by a bellows. The front standard incorporates the lens and shutter, while the focusing screen and film plane are in the rear standard. The distance between the two can be varied to give different image sizes, and one or both standards can be tilted to control perspective and depth of field.

Most of the cameras are of modular construction, which means that components are interchangeable with others in the same range—there is no camera 'body' as such. You could, for instance, make use of any of several film backs, bellows or lenses. On some cameras, especially the monorail type, almost any part can be changed, and even the negative size can be varied by fitting special adapters.

A wide variety of large format cameras have been made over the years, but modern ones fall into three categories. The first is the wooden *field camera*, such as those made by Gandolfi or Deardorff,—the latter has remained unchanged for the last 50 years or more.

Antique *Large format cameras can make good secondhand buys, and you can find a collector's piece in working order. This fine camera dates from 1910*

Dave King/camera courtesy of Teamwork

Arca Swiss *This light, manageable monorail camera costs about the same as a good SLR. The wide range of components gives the system versatility*

Although more limited in range of movements and less strong than other types, it is popular with landscape photographers because it is light and folds up into a compact package. Models which give 5 × 4 inch, 5 × 7 and 8 × 10 inch negative sizes are available, though Deardorff also make 11 × 14 inch cameras to order.

A more versatile version of the field camera is the *technical camera*, such as the MPP. These are generally made of metal and are bulkier than field cameras, but also fold up quite small and are very sturdy. More movements are possible than with a field camera, and this type can also be hand-held—some even have rangefinders.

Folding technical cameras usually have a *baseboard*, which opens like a drawbridge when the camera is opened. The lens moves back and forth over the baseboard for focusing. The baseboard should drop below a horizontal position, otherwise it will appear in the picture in wide angle shots.

The commonest negative size on a technical camera is 5 × 4 inches, though there are miniature versions which give 2¼ × 3¼ inch negatives on roll film, and 5 × 7 inch types are also available.

The most versatile and sophisticated camera is the *monorail*. Front and rear standards are mounted on a rail, and can be moved independently in any direction. When wide angle lenses are used, the two standards are very close

Dave King

Bag bellows *When used with a wide angle lens, the standards of a monorail camera are close together. Bag bellows allow full mobility in this position*

together, so a special bag bellows is available for this purpose. Sinar are among the best known cameras of this type. Some of these cameras have a facility for *on-axis movements*, which means that the standards pivot on the lens axis rather than the base of the camera. This arrangement makes camera movements and focusing quicker and easier.

Monorails are capable of the best results of all large format cameras, but they demand the most skill on the part of the photographer. Furthermore, they are the slowest to use, and the most awkward to carry. The commonest size is 5 × 4 inches, with 5 × 7 inch and 10 × 8 inch sizes also available. Small 2¼ × 3¼ inch versions are sometimes found, as well as 11 × 14 inch models. A number of obsolescent half- and whole-plate sizes can be bought secondhand.

Lenses

Lenses are generally mounted in panels, which simply clip into the front standard of the camera, so you can fit any lens whose image covers the format you are using. Resolving power is not as important as with smaller formats, because the image is rarely enlarged much. Also, because the camera is used on a tripod, small apertures can be used, so performance is usually good anyway.

New lenses for large formats are expensive, but you can buy old ones in good condition quite cheaply—lenses such as the old Dagor or the Tessar can be found at bargain prices. Some of the lenses in use today date back to the turn of the century, and still perform satisfactorily.

Since the 'standard' lens for a given format is roughly equal in focal length to the diagonal of the negative, the standard for the 5 × 4 inch format is 150 mm, and 300 mm is standard for 10 × 8. In practice, though, slightly longer lenses are used—180 mm and 360 mm.

Maximum apertures are small in comparison to those for 35 mm format: *f*/4.5 is quite a fast lens, and a maximum aperture of *f*/6.3 is not unusual. These apertures are mainly used for focusing—the taking aperture is usually a couple of stops smaller, to improve image quality. On 5 × 4 inch, taking apertures tend to be between *f*/11 and *f*/22, while on 10 × 8 *f*/64 is not unusual. This is because the small enlargement factor reduces the effect of diffraction, and also because many large format lenses need small apertures if they are to give sharp results over a large area.

For the camera's movements to be exploited to the full, the lens must cover a wide field—otherwise even a small movement of either standard shifts the image off the film plane. The usual wide angle lens for 5 × 4 is 90 mm, though the Schneider 65 mm is also used, and is roughly equivalent to a 20 mm lens on a 35 mm camera. There are also a few long lenses, mostly 210 mm or 360 mm for 5 × 4 inch format.

Lenses are mounted in their own shutters, although a few technical cameras have focal plane shutters. 'Studio' shutters which can be attached separately are also available, and they can be used with any lens.

Film holders

Large format cameras are loaded by means of a film holder, which has to be pre-loaded in the dark before shooting. The standard film holder is the *double darkslide* or DDS, also called a *double cut film holder*. Manufactured in several of the standard sizes from 2¼ × 3¼ inch to 11 × 14 inch, it takes two sheets of cut film. Film holders have only been standardized over the last 30 years or so, so older cameras may have their own unique holders, and unless you buy plenty of them with the camera you may have trouble finding more. Pre-WW2 single metal holders were often interchangeable, and can also be exchanged with Rada roll film holders. These accept adapters which allow the use of cut film, and which may still be available from some dealers. Another holder, known as the Grafmatic, holds six sheets of 5 × 4 inch film in a rapid change magazine, and fits almost all cameras which accept the DDS type.

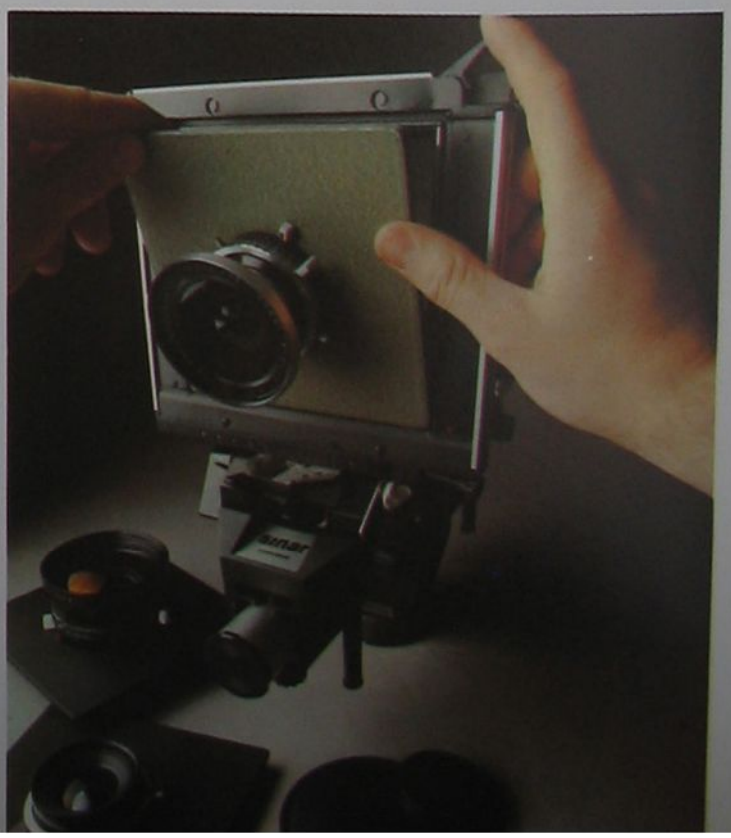
Roll film holders are also available for large format, and are semi-standardized. Some fit almost any camera with a standard 5 × 4 inch spring back, while others fit any with a ground glass removable back. Others still are not interchangeable at all, and fit only one camera. It is essential that you check your camera before buying any kind of film holder.

Most of the major manufacturers make film in sheets and rolls in the majority of the large formats. Here, too, the commonest is 5 × 4 inch. The main restriction is that of speed—as a rule, only medium and medium-slow films are available. Neither Kodachrome nor the faster colour films are available in large format sizes. Ektachrome 64 and Agfa 50 are both available in 5 × 4 and 10 × 8, but Tri-X, Plus-X and some colour negative films are only made in 5 × 4 inch size.

Choosing a large format camera

As with other types of camera, your choice depends on your needs—the types available are quite different, and suit different sets of priorities. Price, too, can be a significant factor.

From the point of view of convenience and interchangeablility, 5 × 4 inch is the best format for most purposes—a wider range of films and film holders is available, and roll film adaptors are easier to find than for the larger sizes.



Lens panels *Unlike 35 mm and medium format cameras, large format cameras do not have bayonet mount lenses. Instead, lenses are changed by substituting lens panels, which are ready-fitted with a lens. This system has the advantage that you can fit almost any lens to almost any camera—the only requirement is that the lens must give an image large enough to cover the negative. This means that even a very old camera can be made serviceable by fitting a new lens*

Darkslide *Most of the large format cameras are loaded with this type of film holder, which is fitted in the dark before use, holding two sheets of film. Many types of film can be used and even Polaroid film is available*

Roll film back *Some cameras can be used with roll film holders—this one gives 6 × 7 cm size negatives on 120 or 220 film*

Dave King

Sinar Handy *Most large format cameras are used on a tripod—this model has a grip which allows it to be hand-held. The camera can be detached from the grip and used as the rear standard of a monorail*

Dave King/camera courtesy of Sinar (Lastech)

to buy a new camera, and price is an important factor, then a wooden field camera is a good choice. However, some good secondhand buys can be found—a used technical camera can cost a tenth of the new price, and is more versatile than a wooden model. The best buys are usually recent but obsolete models from manufacturers still in existence—the pre-Mk VIII MPP Micro technical is an example. Such cameras can be found for about the price a medium zoom for a 35 mm SLR.

If you are buying a secondhand camera, you should inspect it carefully—rough treatment is often betrayed by a battered exterior. Check also that the bellows are not worn or perforated, and ensure that all controls and movements operate smoothly. The shutter release should work consistently on all speeds. If the camera has a flash synchronization facility, test its operation as described on page 752. With care, you can find good quality, reliable equipment—if you make the right choice, your experiments in large format photography should be rewarding.

Larger formats are also more expensive, especially when you consider the price of suitable enlargers. However, if faultless image quality is your first priority, then you might consider something larger than 5 × 4 inches.

If portability is very important, then a wooden camera has the advantage over the other types, as it is light and compact. Furthermore, you can buy a new model for little more than the price of a used technical camera. Remember, though, that camera movements are limited. If, on the other hand, compactness is not important, but you want the widest possible range of camera movements, then a monorail is your best bet, even though you will need some practice before you can use it to the full.

Some of the more sophisticated cameras are very expensive—a new 10 × 8 monorail with a couple of lenses can cost as much as a small car. If you want

Large format kit *With this diy kit you can build yourself a wooden monorail with the full range of movements*

Winter sport

Dynamic action, brightly coloured figures and snow clad backdrops are the hallmarks of winter sports. But the best shots come from thinking carefully about your approach to each of the events

John Cleare/Mountain Camer

Leo Mason

Downhill skier *The vertical format has been deliberately chosen to emphasize the diagonal tracks of the skier. A horizon would have been a distraction in this shot but the red clothing gives the skier prominence despite his relatively small size.* **Bobsleigh** *A slow shutter speed recreates a spectator's impression*

Winter sports offer the photographer an exciting range of events to cover on a winter holiday, from the breathtaking speed of downhill racing to the graceful movements of the skating rink. Often the weather conditions are fine and sunny, with only the occasional problem caused by extreme cold, and you often have the chance to combine an action shot with a beautiful snowscape in the background.

Most people want to take photographs of skiers in action as their first priority on a winter sports holiday. Photographing the ski classes in progress does not usually produce very interesting results since the background tends to be cluttered with other classes and you may make yourself very unpopular with the instructors. However, the same instructors will often be only too happy to show their skills and perform manoeuvres for your camera when the classes are over for the day. At this time, towards the late afternoon, the sun is low and you can make use of attractive backlighting if you position yourself just below a slope as the instructor skis down towards you. It might help to place a marker at the precise point that you want him to turn, so that you can frame and prefocus

protect the lens from the snow and ice which will inevitably be thrown up on a mountainside. Carry some spare batteries in an inside pocket as the low temperature can drain them very quickly. With all snow subjects you must be careful with exposure readings, since the overall brightness of the picture will confuse most camera meters. Use your hand in the same lighting plane as the subject as an exposure guide.

It is quite difficult to take really creative pictures of downhill racing, since skiers are likely to reach speeds of 120 km/h and will be in view from any position for a very limited time. The best pictures occur at tight corners, after a long straight or at humps in the surface where the racer becomes airborne. If you are lucky enough to obtain a side view of a steep straight from which you can pan the camera with the racers, this is one of the best positions to take up.

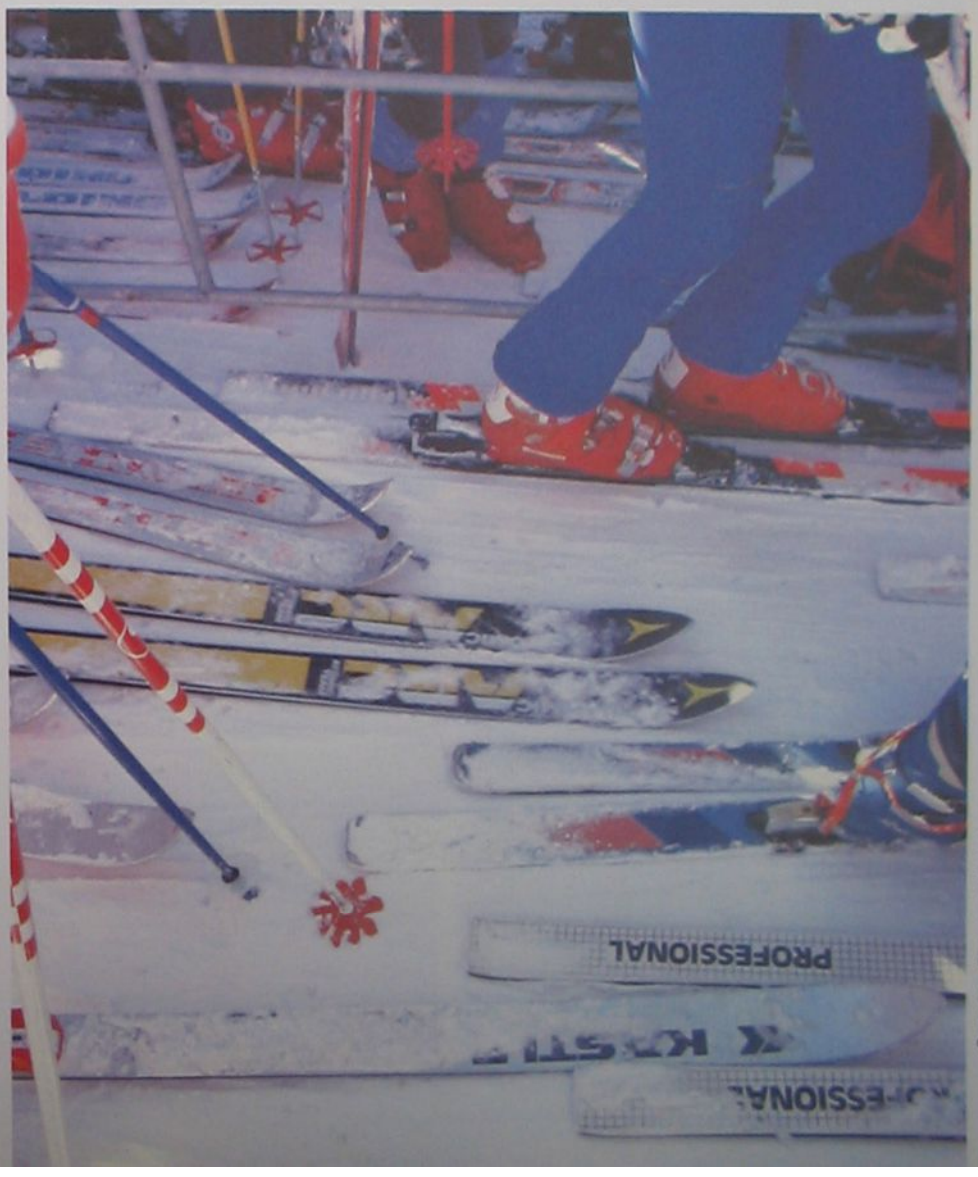
Panning shots can be very effective if you choose the background carefully. Skiers can appear quite motionless when panning against clear sky or snow, but trees or even spectators can provide you with a blurred background on which to outline your subject.

Looking down *Winter sport shots need not be all at long range. Here, the photographer has found a colourful and graphic composition at the skiers' feet*

your shot. Undoubtedly, this type of set up shot will give you much better results than you can hope to achieve when taking quick snaps of passing skiers. The more athletic ski instructors may be willing to perform more daring feats for you, such as different jumps, and may know a location where you can shoot from underneath the jump itself. In this case, position yourself so that your picture will include snow as well as sky, take your exposure reading carefully, and ask the instructor to call out as the take-off point is reached. Even with this call, precise framing will be down to luck, and this may be a good occasion to use a motor drive.

Organized winter sports events present you with more of a challenge. The main Alpine events are usually downhill racing, slalom and giant slalom, although some areas also have facilities for ski jumping and bobsleigh racing, and you may get the chance to see some skating as well. Scandinavian countries are the most likely places to find Nordic events, such as cross country skiing and the biathlon competition.

If you are taking pictures and skiing yourself, the equipment you carry should be kept to a minimum. It is not worth taking a tripod to a sports event, since it is cumbersome to transport and quite difficult to use on steep and slippery slopes. A monopod, however, will be very useful for most shots. Two lenses, such as a wide angle and a long telephoto or zoom, should give you enough versatility to cover most events creatively. A normal skylight filter will



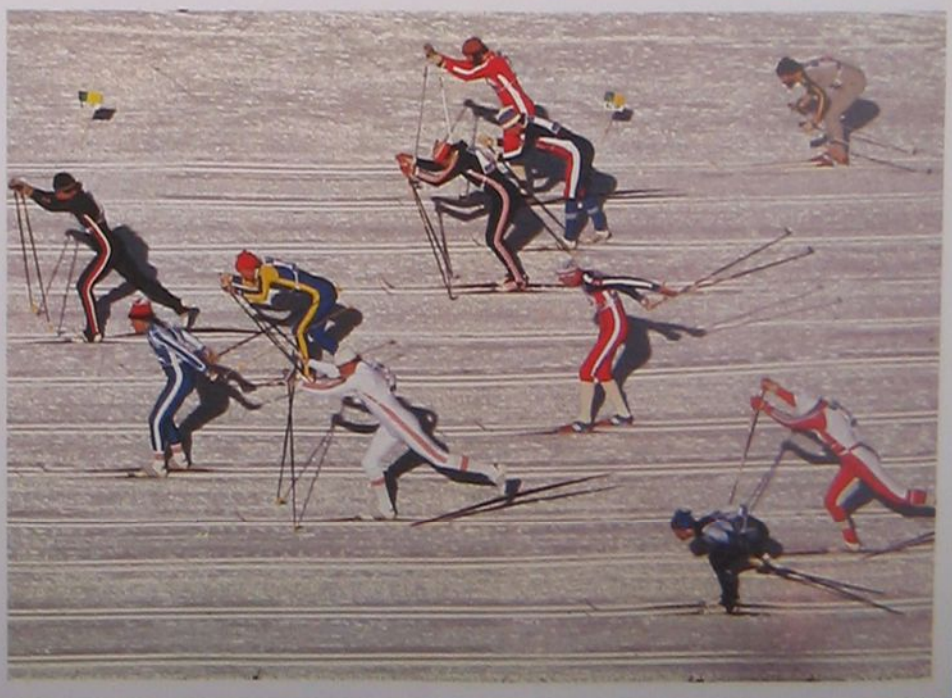
Sporting Pictures UK Ltd

Sporting Pictures UK Ltd

Bobsleigh and helmets *One of the problems with sports photography is that by concentrating on the action it is easy to overlook shots like this*

Nordic Games Relay *A long focus lens has isolated the skiers from their surroundings, concentrating on their colours and the tracks in the snow*

Most courses are marked out several days before the event so that skiers can practise, so make the most of the opportunity by spending some time walking down the course to select good camera positions and trying some shots. Since there is considerable danger on account of the speeds involved, spectators are kept well back, and some corners are protected with heavy nets. Consequently you will find that you need a fairly long, though manageable, lens—a 200 mm is suitable. For cornering shots pick a position so that the skiers face you as they turn. Cornering can be very dramatic at this sort of speed, especially as the races often take place on ice



Leo Mason

John Zimmerman

Stewart Fraser/Colorsport

Snowspray *Backlighting is very well suited to winter sports—this is particularly true when it shows snow flying up against a blue sky*

Biathlon *Falling snow underlines the arduous circumstances which face competitors in the biathlon—a test of skiing ability and marksmanship*

rather than snow, and as the skier makes the tight turn a spray comes up from the edge of the skis. This arc of flying snow can often make an attractive contribution to the picture, so allow space for it.

Alternative positions during the race are at the start or finish lines from which you have the chance of completely different compositions. At the start, the skiers come through an electronic gate to commence their run, and to achieve maximum speed they usually try to jump into the start. A viewpoint from the side with a wide angle lens can give you an effective picture of these strange figures in their one piece suits and space age helmets, as they contemplate the awe-

inspiring run in front of them.

The finish, usually a circular area, features the racers braking in a spray of snow, at which point they usually lift their visors quickly to read their speed on the electronic scoreboard. Most of them stop in the same position which will help you with framing, so you may well be able to choose a viewpoint from which you can include a skier's face in the foreground and the scoreboard in the background as a balanced shot. Expressions of anguish, or of jubilation on the competitors' faces may complete a successful picture.

At slalom races, in which skiers choose the fastest route between flags (or gates), speeds are slower, and it is often easier to get closer to the event. Slalom skiers wear different clothing which is usually more colourful and distinctive. The coloured flags, alternately red and blue, can add considerably to the composition, but are also useful points on which to prefocus, so that you can be sure of having the skier in sharp focus as he or she rounds them. A low viewpoint ensures a clear view of the skiers under the flags, and also makes the flags appear to be more of a hazard than they really are, projecting high above

John Cleare/Mountain Camera

Skier's shadow *By looking out for unusual subjects the photographer has exploited what usually is a problem—shaded snow appearing blue*

Speed skater *The shape of the skater's body is the important feature of this shot, so it is crucial to choose the best moment for releasing the shutter*

the competitors from this angle, and usually giving an added balance to the composition. If you can, try to choose a viewpoint which gives a dark background, perhaps of trees or chalets, and the flying spray of snow as each racer rounds a flag will have far more impact in the picture. Later in the day, when low sidelighting casts long shadows across the snow, the patterns made by the slalom runs stand out clearly and can offer some effective abstract shots.

Nordic events are much more sedate than Alpine racing as the courses are comparatively flat, and there are no problems of access or of working on steep slopes. The cross country race is usually entered by a huge number of competitors who follow a set course over some distance. This is the opportunity to incorporate landscapes into your composition, using the figures, perhaps, as features of foreground interest. The tram line tracks that are made by such large numbers of skiers can be used in the picture to give depth and perspective. At these events starts and finishes do not provide the best photographic opportunities. The beginning of the race is generally very early in the day when light levels may be extremely low, and at the end the competitors often do not even know who has won the race.

One of the most popular events in winter sports competitions is ski jumping. For the photographer, however, a lot depends on position. A viewpoint from the side enables you to pan with the skier as he or she plunges forward, giving a good impression of speed providing that the background is one that streaks effectively. It is worth waiting for the moment when the skier leans forward at such an angle that head and ski tips seem to be almost touching. At big events it is difficult to gain access to the top of the jump, but you should be able to visit this when there is no competition taking place. A wide angle shot looking straight down the jump can give you a good panorama of the surrounding landscape, and a dramatic picture of the prospect facing the ski jumper, as well.

Although you may have difficulty gaining access to the start of the bobsleigh course, the most exciting pictures usually occur further down the run where there are no restrictions to photography. Look out for the positions which professional photographers and television crews adopt, if you are unsure where the action may unfold. As in downhill skiing events, tight corners give a flurry of snow. Panning shots can be successful in this event, as in other winter sports, as the sled and team form a solid block of colour. Alternatively, let the bobsleigh blur into a streak of colour, or, if you have a wide angle lens, try to include the track on either side. Catching the bob as it rides up the ice wall on a corner can produce a very dramatic shot, particularly if you tilt the camera so that the angle seems to be even more extreme. The bobsleighs travel at huge speed, so it is worth practising your technique on the first few contestants.

Ice skating is a very different sport indeed from those already mentioned. Although ice skaters can travel extremely fast, especially in speed racing events, most other winter sports are concerned with speed, whereas skating is expressed in a series of graceful, balletic movements and positions. Of these, the simplest jumps and turns often make the best pictures, and, once again, you will achieve the best results if you ask a good skater to assist you by posing for your camera, rather than grabbing quick shots of passing skaters. Use a fast shutter speed and ask your subject to perform a 'stag', 'butterfly' or 'bunny' jump for you. All these jumps give clear, sleek outlines, providing that you have a good viewpoint and that the background is fairly clear. If you are presented with a difficult background, use selective focusing or flash if you are close enough, to separate the skater from the surroundings. To get a dramatic effect, photograph these jumps from a low angle so that the skater appears to be much higher up off the ice than he, or she, really is. The most complicated jumps, such as the 'double axel' do not make the most successful pictures.

The best place to photograph skating is at an outdoor rink where you have the chance of a beautiful mountain backdrop as a setting for your pictures. However, if the background happens to be unattractive, and the weather is at all sunny, point the camera down, instead of up, and you will find that the skater's shadow on the ice, particularly in certain positions, forms a dramatic complement to the action. Occasionally, a shadow may be so effective that it makes a picture in its own right. Remember that ice reflects a great deal of light, and can easily mislead a light meter.

Ski jump *Pan shots are more effective if the background contains trees or buildings. Here, its dark colour also contrasts well with the competitor*

Stewart Fraser/Colorsport

Darkroom

Photodrawing

Photodrawings based directly on photographs can look just like works of art, yet are attractive and original products of a few simple darkroom techniques

Making a freehand pen and ink drawing seems, at first sight, to be the exclusive preserve of an accomplished artist, but with a few simple darkroom techniques, almost anyone can make attractive line drawings based on black and white photographs.

Although there are many different ways of achieving successful results, there are four particularly simple methods: the *ink line bleach* or *bleach out process; blue toning; acetate drawing;* and *direct drawing*. All are remarkably easy to do, but by far the simplest and most effective is the ink line bleach process.

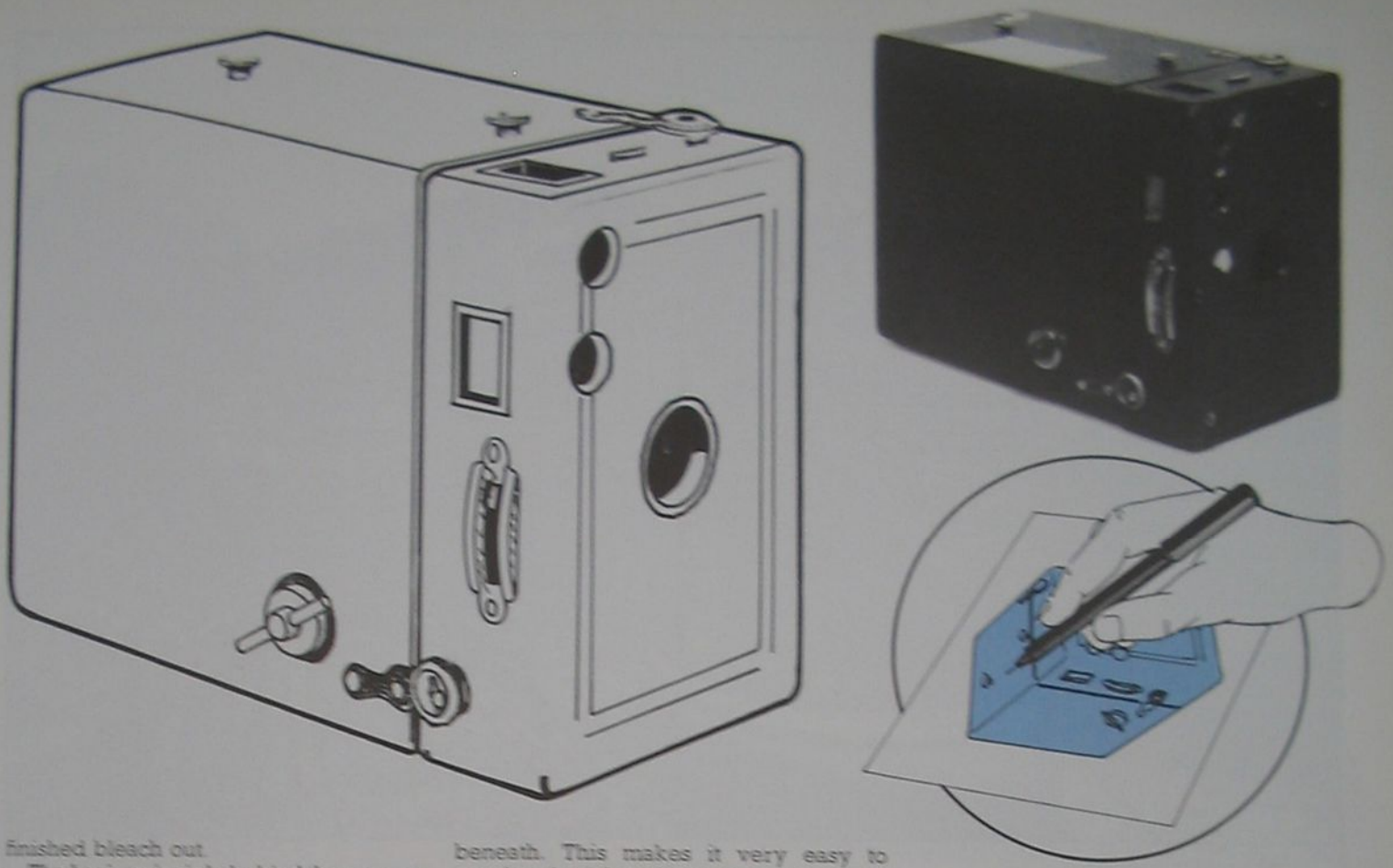
Lee Thomas

Ink line bleach

You can make a drawing by the ink line bleach method using your normal black and white printing equipment—though an extra processing dish for the bleach process reduces the risk of contamination. For a 10 × 8 print, you need a dish capable of holding one litre of bleach. For really fine drawing you also need a good quality draftsman's ruling pen with 0.18 or 0.35 nib—the finer the drawing point the more intricate the detail can be. Other ink pens can be used, as can fine brushes, but beware of nibs which are sharp enough to scrape away the emulsion and supporting layer, particularly with RC paper. A round bladed scalpel with sharp blades is also useful for *skimming* (scraping) ink from a print and knifing out marks on the

Lee Thomas

London scenes *The originals for the two drawings on this page were colour slides. Each was projected on to ordinary black & white printing paper to produce a paper negative from which a contact positive was made. Using a lightbox, a tracing was made, with vertical ink strokes. The result was copied on to lith film, from which final prints were made. These can be hand coloured for added effect (top). If small size tracings are made, you may be able to use these for making same-size contact negatives. Tracings can be made on paper acetate sheet, using a similar technique*



Robert Hurst

finished bleach out.

The basic principle behind the process is very simple—you simply draw in ink over detail in a normal print and then bleach the print to leave only the ink drawing. You can make an ink line bleach drawing from any photograph but it is better to choose a very simple image to start with—simple images usually work better anyway. Make a very light print with just enough detail for the subject to be recognizable. You can do this in one of two ways. Either make a print with one third of the correct exposure and process this normally, or give the print massive overexposure—perhaps four to six times the correct exposure—and process the paper in a weak (half-strength) developer solution, taking the print out just as the image starts to come up. The overexposure ensures that both highlights and shadows are visible.

Dry the print normally and then lightly sketch over the main details of the picture in waterproof Indian ink. Do this as if you were tracing the image, and use dots, lines or hatching to build up the image. Detail can be added later, so do not obliterate the print with ink at this stage.

Leave the print face up and leave it to dry thoroughly overnight. This is especially important if RC paper is used since the ink takes poorly to the print surface.

The next step is to remove the print image by bleaching, leaving behind the Indian ink drawing. The action of the more powerful bleaches can sometimes affect the Indian ink or emulsion of the print and even attack the resin coating beneath. This makes it very easy to smudge the ink and you must handle the print very carefully during bleaching.

The bleach bath

You can make a bleach very simply from potassium ferricyanide crystals and hypo (Farmer's Reducer see page 767), but this is rather slow acting and does not always remove the image cleanly. Although more complicated to make up, a dichromate bleach formula such as Kodak R21 works better. To make the two part solution, dissolve 50 g potassium dichromate in one litre of cold water then add 50 ml of concentrated sulphuric acid, stirring the cold solution constantly as you add the acid. Remember, you *MUST* add acid to water carefully. Under no circumstances add water to acid. Wear eye protection against splashes—even a pair of sunglasses is better than nothing. Wear old clothes and a pair of chemical-resistant rubber gloves.

One part of this stock solution is diluted with nine parts of water to make bath A.

For bath B, dissolve 50 g sodium sulphite (anhydrous) and one gram of sodium hydroxide in one litre of water. This solution is used without further dilution.

All the components of R21 are toxic or corrosive and should be stored in expander type polyethylene or glass bottles as they attack metals and organic tissue.

Perhaps the best bleaches for cleanly removing an image are those used in E-6, C-41 and Cibachrome processes as they are fast, thorough, readily available in package prepared form and require the minimum of mixing. With these bleaches, follow the maker's mixing and special disposal instructions closely. It is best to use spare bleach left over from colour processing.

Shelf life for a full bottle of working strength Cibachrome bleach is about eight weeks. E-6 and C-41 bleach shelf life is around six months. Partly filled bottles always have a reduced shelf life because of oxidation. Clearly label all storage bottles and keep chemicals in storage well away from food, pets and children.

Blue tone *A method ideally suited to making simple line drawings from black & white photos. Tone the original blue, ink over important detail then make a copy on ortho film*

John Ward

Direct drawing *A flat, very low density print formed the basis of each of these two line drawings. A fine point drawing pen was used to fill in detail on the prints, then large areas of tone were built up using dry transfer tone. A continuous tone film copy preserves the light greys of the deepest shadows of the base print, but a lith film copy strengthens the line effect*

Bleaching technique

Whichever bleach you use, you must first presoak the print to ensure even bleaching, handling the print only at the edges. Carefully place the print so it floats face up in a dish containing the bleach—with R21, it should be solution A. Gently rock the dish to flood the emulsion surface with bleach and let the print sink gently towards the bottom.

Continue rocking the tray until one minute after the original photographic image has disappeared entirely. With E-6 and C-41 chemicals this should take two to four minutes with fresh solution. After about seven minutes use, the solution will be exhausted and should be replaced or it may cause staining. With R21, leave the print in solution A for five minutes, rinse the bleached print in running water and then transfer to solution B for a further five minutes. No fixing is required.

Lift the print carefully out of the solution and drain off excess bleach. Transfer it to a dish of water and wash for ten minutes rocking the dish occasionally. After using E-6, C-41 or Cibachrome bleach, follow bleaching by a thorough rinse and then a bath of normal non-acid fixer before the final wash.

After a 20 minute final wash, the ink line bleach drawing should be ready to dry. If you can, try to avoid touching the print for 24 hours—it can take this long for Indian ink to dry out completely. Addition of detail and some retouching may be necessary at this time and knifing and spotting methods are shown on pages 766 to 769.

As a precautionary measure make a copy on lith film. This enables you to print reproductions of the drawing without having to repeat the ink/bleach stages again.

Blue tone drawing

For the blue tone method, you need an inexpensive blue (iron) toner. These are simple to use and store (see pages 710 to 713).

Start by making a light density print, as for ink bleach out, and then blue tone it in the normal way. Once dry, sketch over the details in Indian ink and while it is drying, set up your enlarger or camera arrangement ready for copying (see pages 1121 to 1123).

Use a film such as Kodalith ortho 2556 type 3 to make a line copy negative of the blue toned drawing. The blue toned parts of the image reflect blue light to which the film is sensitive. But the Indian ink drawing is black, does not reflect light, and so will not record on the lith film emulsion. A print made from this negative reveals only the Indian ink drawing.

The advantage of this method is that you achieve an apparent bleach out without actually using bleach solutions.

Acetate drawing

The great advantage of acetate drawing is that no chemicals are required. If you have a line copy set-up—using your enlarger or camera—you need only buy some clear acetate from an art supplier, although it is quite important to test a sample if possible before buying—some types do not allow ink to key to the surface. You need acetate for what is called 'layup' use—a good art supplier should be able to advise and recommend something suitable.

Use a sheet slightly larger in area than the portion of a print from which you are drawing. Tape the acetate so that it remains in register with the original print, and trace over the image with a ruling pen. Let the ink dry overnight and copy on to lith film against a matt white paper background. You may also be able to make a copy by direct contact printing methods by using the acetate to make a same-size negative.

Direct drawing

Unlike the other methods, direct drawing produces a pen line drawing with shadow detail. As with ink bleach out and blue toning, start with a light, overexposed but greatly underdeveloped print to leave a very faint, flat image on which to work.

Draw over the details with a ruling pen but do not use dots or hatching for shadows—the silver image will provide the subtleties and shadows. You can copy this on to a slow fine grain continuous tone film to retain all the fine shadow detail in the picture.

John Ward

Alternative originals

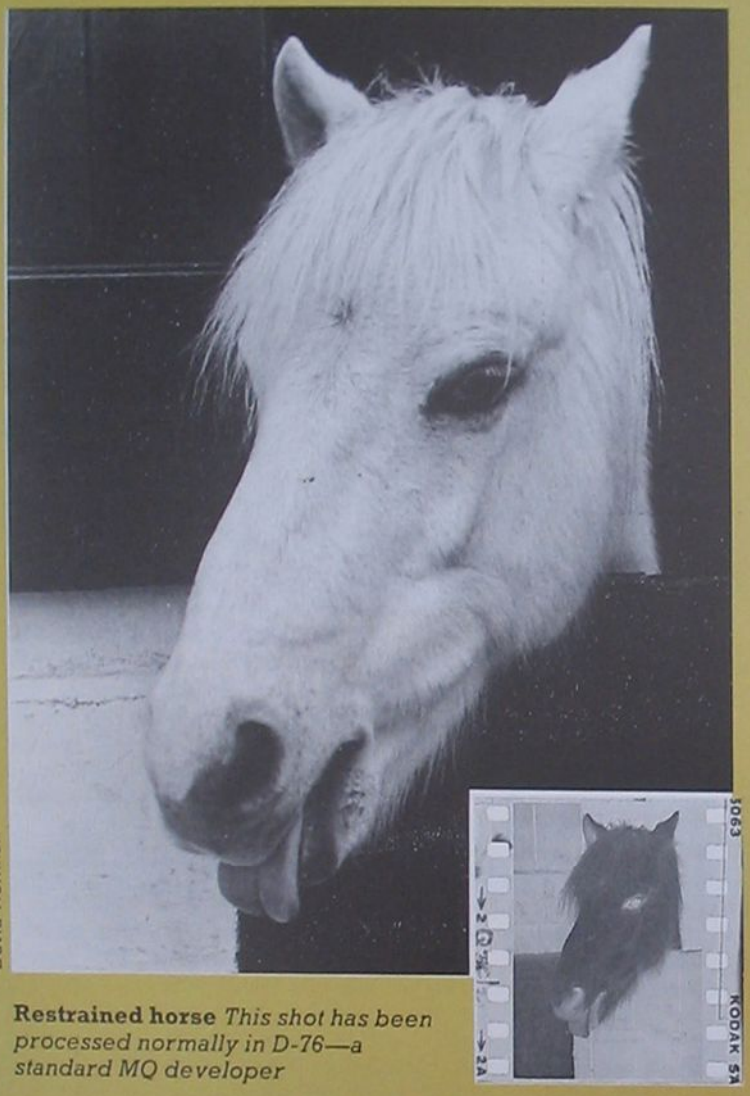
Another way to create photodrawings is to dispense entirely with any form of original photograph. Instead, for your starting 'negative', scrape, etch, paint or draw an image on to any material which can act as the negative. For instance, use a small piece of plate glass and carefully blacken one side of this over an untrimmed candle flame. Use a fine point tool—such as a cocktail stick—to scrape lines in the soot, and wipe away larger areas with a cloth. Carefully position this 'negative' into the slot on your enlarger head normally occupied by the negative carrier, and print the image as you wish. You may have to arrange additional baffles to cut out light leakage from the enlarger head. A similar effect could be obtained by carefully scraping away the emulsion on a piece of blank film—try moistening the film first. Sheets of acetate can be used instead of glass and have the distinct advantage that they can be cut and enlarged just like ordinary negatives. Different effects can be obtained if you use various types of spirit-based or water-based marking pens.

Mirella Ricciardi/Colorific

Understanding...

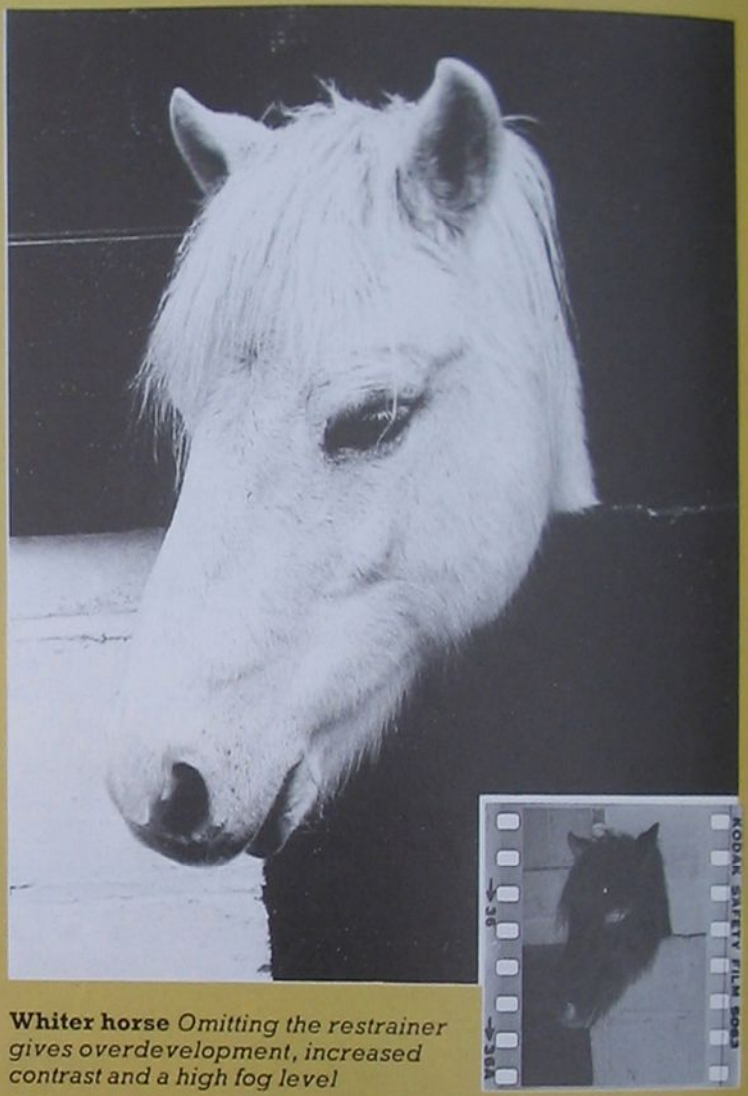
Developer additives

A developing agent cannot be used on its own to process film or paper. Other chemicals are needed, and the way in which they are used has a great effect on the characteristics of a developer



David Hoffman

Restrained horse *This shot has been processed normally in D-76—a standard MQ developer*



Whiter horse *Omitting the restrainer gives overdevelopment, increased contrast and a high fog level*

There is more to making a practical developer than dissolving one or two developing agents (see pages 1604 to 1605) in water. To begin with, most developing agents work fast enough only in an alkaline solution. It is easy enough to make the solution alkaline by adding an alkali, and the developer will indeed work. But in a short time the air above the solution will cause it to oxidize—it will turn brown and become useless. To prevent this a *preservative* is included in every developer. Another problem is that some developing agents are very active and tend to develop even the unexposed grains, producing excessive development fog. So a *restrainer* is usually added to keep fog to a minimum but without holding back normal development.

So a practical developer consists of the *developing agents*, an *accelerator* or alkali, a *preservative* and a *restrainer* or *anti-foggant*.

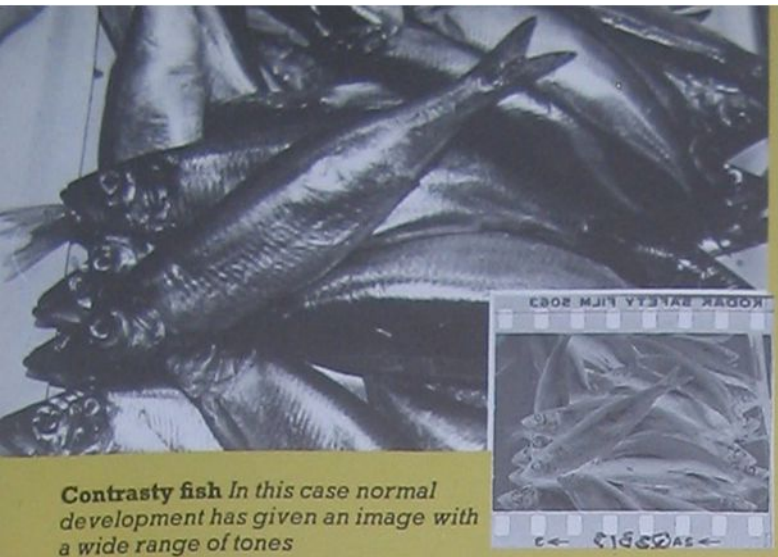
Alkalis

The most generally used alkali is sodium carbonate, available in either the crystalline or anhydrous form (see page 1561). Only one third the amount by weight is required of the anhydrous form compared to crystals.

For certain kinds of developers carbonate is not powerful enough, and line and lith developers based on hydroquinone as the sole developing agent usually contain one of the caustic alkalis—sodium or potassium hydroxide. These developers have a soapy feel and, being caustic, should be handled wearing rubber gloves.

On the other hand, low activity developers, such as those designed to give fine grain, call for even less powerful alkalis than sodium carbonate. One of these is borax (disodium tetroborate), which is used in the identical formulas for Kodak D-76 and Ilford ID-11. An alkali produced by the Kodak company under the proprietary name 'Kodalk' has an alkalinity midway between that of sodium carbonate and borax. It is usually stated to be sodium metaborate.

The alkalinity of a developer has a big influence on its activity. One problem that can arise is that as development proceeds the alkalinity tends to be reduced by the formation of hydrobromic acid. What is needed is some sort of *buffer*—in chemical terms, a constituent that maintains the acidity or alkalinity at a fairly constant level. In the case of sodium carbonate, which is formed from a strong base and a weak acid, the alkalinity tends to remain constant because small additional amounts of acid have little effect. But in caustic hydroquinone developers, the high alkalinity is



Contrasty fish *In this case normal development has given an image with a wide range of tones*

Flat fish *Reducing the amount of Metol gives underdevelopment, though contrast is maintained*

maintained only by using sodium or potassium hydroxide in large quantities so that the developer remains active during its working life.

Very active developing agents such as Metol can operate in solutions of low alkalinity, and will work in a solution containing only sodium sulphite. This is the basis of a very simple and efficient fine grain developer. One developing agent, Amidol, which is no longer available, actually operates readily in acid conditions.

A term often used when discussing acidity and alkalinity is pH, (pronounced 'P-H'). Pure water, which is neither acid nor alkaline, has a pH of 7. Acidic solutions have smaller values of pH, and alkaline solutions greater. A caustic hydroquinone developer may have a pH of about 12 and a carbonate PQ or MQ formula about 10.

Excessive dilution of the developer reduces its alkalinity and leads to a change in its properties.

Preservatives

Almost invariably, sodium sulphite is used as a preservative. Like sodium carbonate, it is available in crystalline and anhydrous forms. Although it is so widely used the exact way in which it works is unknown. In the case of hydroquinone, however, the precise action is that the sulphite reacts with it to form hydroquinone sulphonic acid, which is resistant to oxidation from the air but is still able to reduce silver halides to pure silver.

One type of developer in which only a minimum quantity of preservative can be included is a colour developer. Too much preservative would restrict the way in which the by-products of development interact with couplers to form the dyes. A typical colour developer therefore may contain only 5 grams per litre of anhydrous sulphite as against 50 grams per litre in a black and white developer. As a result, colour developers are generally more susceptible to oxidation and their storage lives are comparatively short.

Anti-foggants

The traditional restrainer is potassium bromide in amounts rarely exceeding 5 grams per litre. It is not known precisely how bromide works as a restrainer of development fog, but it is extremely effective, though there is a small loss in emulsion speed.

In recent years there has been increasing use of organic restrainers which are very effective anti-foggants but have no effect on image density.

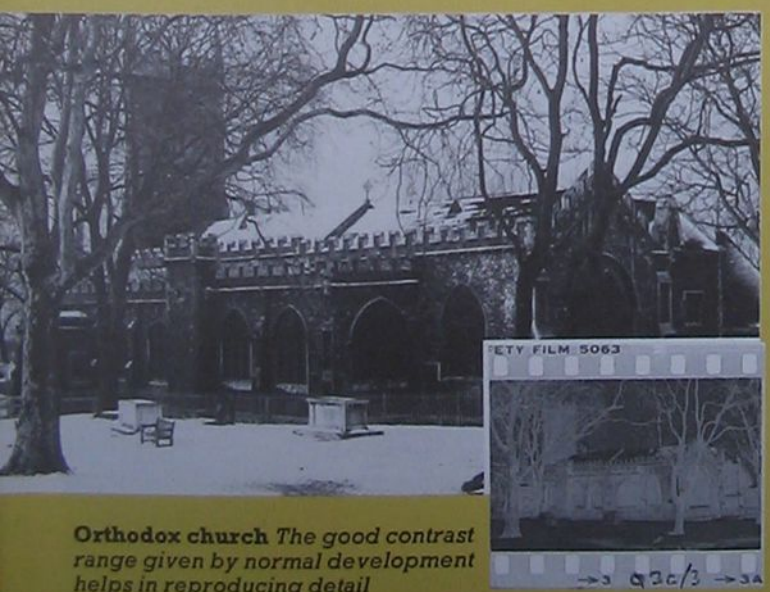
Benzotriazole is widely used for this purpose, and has the added advantage that it is much more effective at restraining Phenidone than is potassium bromide. It is used in PQ developers in quantities of 0.2 g per litre.

Both restrainers and accelerators can affect the appearance of highlight and shadow detail, just in the same way as the developing agents themselves.

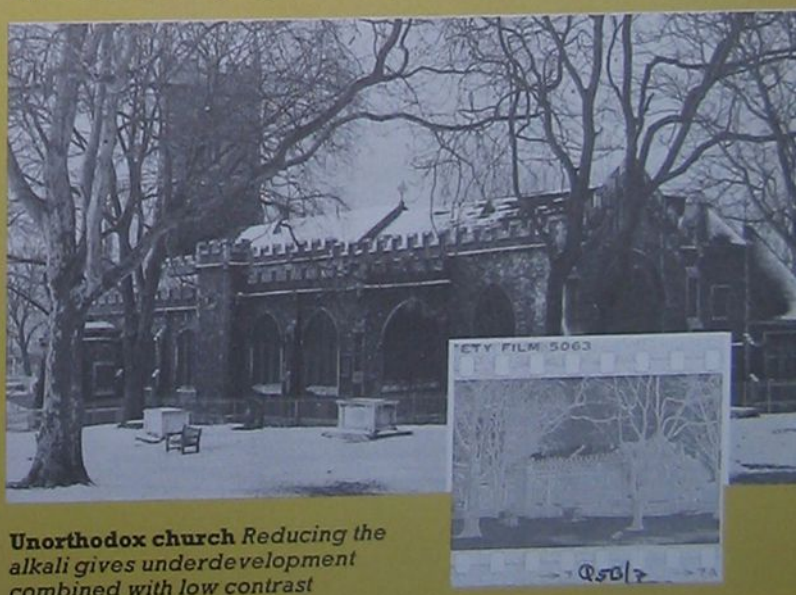
Developers in practice

When preparing a developer it is usual to dissolve the developing agent or agents first in warm water and then, without undue delay, to add the preservative. Powder developers are packed as two components, called A and B, which are dissolved in that order.

Some developers are stored in the form of two solutions which are mixed together just prior to use. One solution contains the developing agent and a preservative while the other contains the alkali. The solution with the developing agent may be made acidic by using a metabisulphite instead of sulphite and this gives the solution a very long shelf life. Only on mixing the two solutions is the working developer made active by the presence of ample quantities of alkaline solution.



Orthodox church *The good contrast range given by normal development helps in reproducing detail*



Unorthodox church *Reducing the alkali gives underdevelopment combined with low contrast*

Amos Schliack

The cultures of South East Asia and unusual rituals peculiarly associated with religious ceremonies particularly interest this enterprising young German photojournalist

At an age when many photographers are just beginning to reach the top, Amos Schliack had been travelling so much and for so long that by 30 he was already contemplating taking a sabbatical from photography. As a photojournalist for international magazines such as *GEO* and *Stern*, he is away from his home in Hamburg for ten months out of the year, hardly ever seeing it for more than a week at a time. He has been working in photography at this non-stop pace for seven years.

But despite this demanding schedule, his energy and his enthusiasm for photography still seem boundless. Even now, he stays at home after one assignment only long enough to edit the pictures and pack his equipment for the next. His assignments range from colour features on various people and places, through black and white reportages, to brochure production for different tourist authorities.

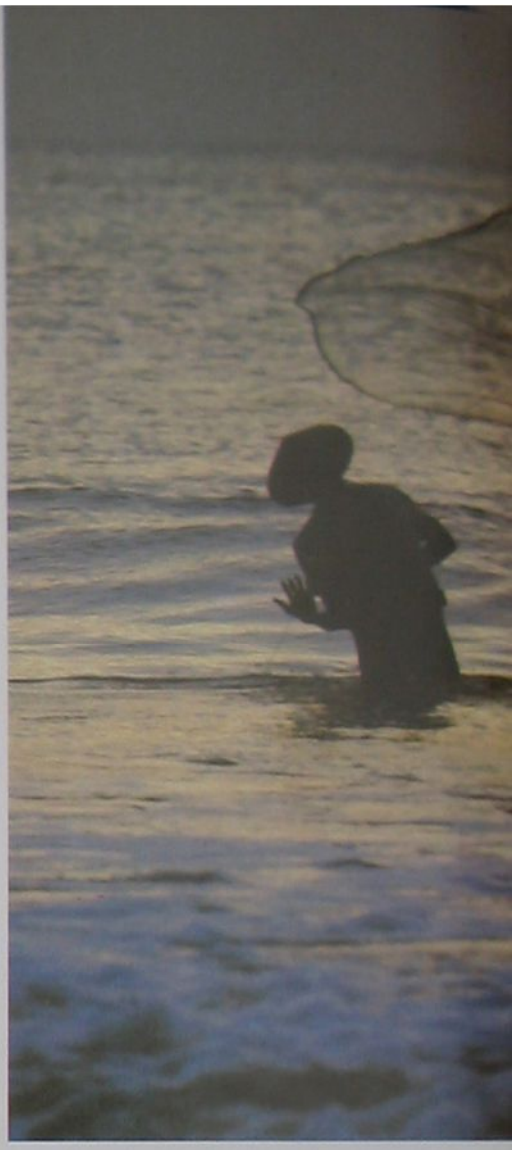
Like many other professional photographers, Schliack did not set out initially to become a photographer. Photography was only a hobby when he went to university in Berlin, where he was studying architecture. After two years, however, he became disillusioned with the profession and ended his studies. He travelled for a year and in this time met and made the friendship of Herbert List, a surrealist photographer famous in the 1930s. It was this association with List that finally persuaded him to turn his hobby into a full-time profession.

Although right from the beginning he had no doubt that he wanted to photograph the real world outside, he decided to train in the studios of fashion and advertising photographers where he learned technique and the organizational skills essential for a professional. One of these was Ben Oyne whose style was 'realistic'. Rather than creating the glossy artificial images typical of studio work, Oyne aimed to produce shots that had the look of reportage. Indeed, he rarely, if ever, used professional models.

Schliack worked for a number of busy professional photographers, but after three years he began to find that he had little time for his own photographs, and so he decided to go it alone. 'After three years, I knew about photography, but I was not sure I had the talent to be a photographer myself—so I had to go out and put myself to the test with a camera!'

Needless to say, he did prove himself as a photographer and soon received his first assignment, which was for *GEO* magazine. He was asked to do some additional work on a story that had already, but incompletely, been done. This was six months before *GEO* started to publish, and Schliack has been working for them ever since.

Schliack has photographed a wide range of subjects both within Germany and elsewhere, spanning everything from pollution to semi-precious gems. But his main interests, both personally and professionally, are in the cultures of



Amos Schliack/Focus

Casting for fish *To get this fine silhouette of an Indonesian fisherman, Schliack had to rise at dawn*

Trance dance *A young Balinese girl dances at a major religious festival held once a century at Besakih Temple*

Sunset in Vermont *Schliack used a 16 mm wide angle to capture the beauty of this forested shore at sunset*

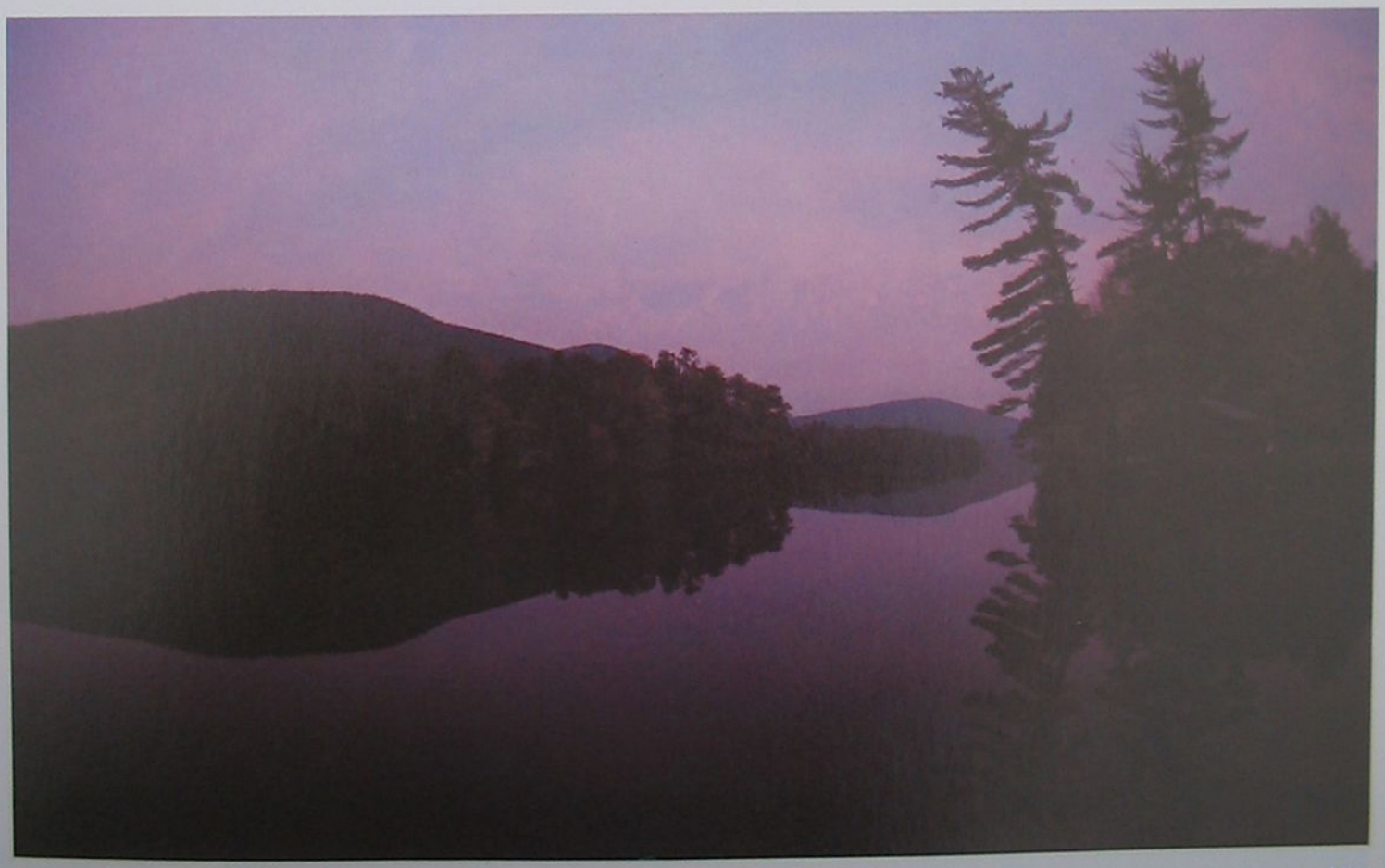
Amos Schliack/Focus

South East Asia and the Middle East and in religions—he is fascinated by the unusual facets of personalities revealed during religious ceremonies. His interest in religion has taken him to Greece, where he did a story on the monks at Mt. Athos, to Mexico where he covered the annual pilgrimage to Guadalupe, and to Jerusalem, where he has been on nine separate occasions.

Jerusalem is one of his main subjects, and is one that has provided him with greatest satisfaction. 'I think it's the most universal and absurd place I've ever seen in my life. One of the reasons that I go there again and again is that there is so much to learn about the city. After three or four weeks in any other place, I feel as if I've covered it thoroughly, but whenever I leave Jerusalem I feel as if I've barely scratched the surface.'

One of his most rewarding assignments stemmed from a proposal he made to *Stern* magazine to report on a German hospital that treats children suffering from cancer. Unlike most of the previous assignments, which were largely colour essays on foreign cultures, this was black and white reportage work and if it had not been for his involvement in the subject, he would have found it tough going.

The idea for the story came from personal experience—a close friend had contracted cancer and undergone a long process of treatment. Seeing a photo-essay on the subject done for *Life* magazine, he felt that the subject was not portrayed realistically or sensitively enough. 'And so the next step as a

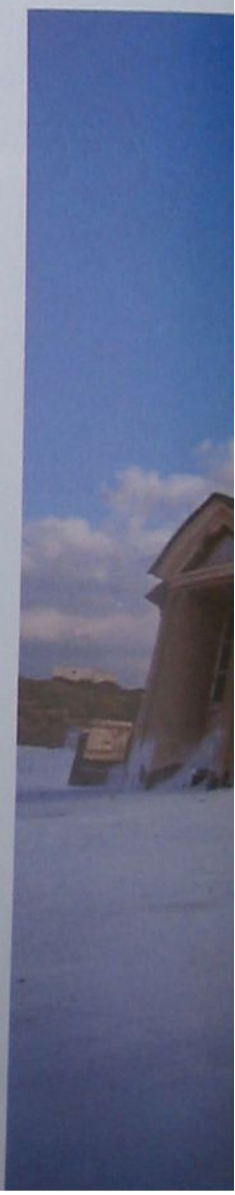


photographer was to ask myself how I would do it.'

He spent three weeks in the hospital working on the story, photographing the children and their parents. After this time he found that he could not photograph anymore. He became so emotionally involved that he reached a point where he could no longer keep his distance from the subject and simply could not take pictures. 'I started to dream of these children, and whenever I saw children on the street, I would imagine that they all had cancer.' The story had been finished, however, and remains, for him, the most exciting that he has ever done.

The key to his success with this and many other subjects was, he feels, his receptiveness and his willingness to learn from a situation rather than prejudging it. Unlike most professionals, he rarely researches his subjects very much before arriving on a location to photograph. He relies on first impressions, trying to interpret the subject without any special information about it. 'I think that you have to be very empty when you

Reclining Buddha (*above*) *and some followers in Chiengmai, Thailand*
Meditation *A monk from the monastery at Mt Athos, Greece silhouetted against the sun on this isolated island*



Amos Schliack/Focus

photograph. You should empty yourself and become part of the situation as much as you can.'

After travelling all over the world and working in many different situations, he is rarely daunted by practical or technical problems. 'If I'm excited about something, I can go through a lot of hardships. I can walk or run or go without sleep for three days. These are not the things that are difficult for me.'

What he does find difficult is doing a story in which he finds no particular interest. Apart from the story on cancer, he finds German stories hardest for just this reason. 'I don't think people are very sensitive about their own countries, as they've seen it so much.' He describes

Rendille beadwork (*above left*) *Elaborate decoration for the head of a young tribesman in Kenya*
Jerusalem (*above*) *Traditionally dressed, this Jewish man carries home palm fronds for religious celebrations*
Mt Carmel, Israel (*below*) *A wide angle lens has been used to great effect to show the priest outside his church*

Bali funeral *The atmosphere of these elaborate rituals has been caught by underexposing and shooting into the sun.* **Borovodur, Java 1978** *Schliack used a high viewpoint to capture the story of this restoration in a single image*

working on a story about a picturesque part of Germany as "being like falling asleep while you are taking pictures."

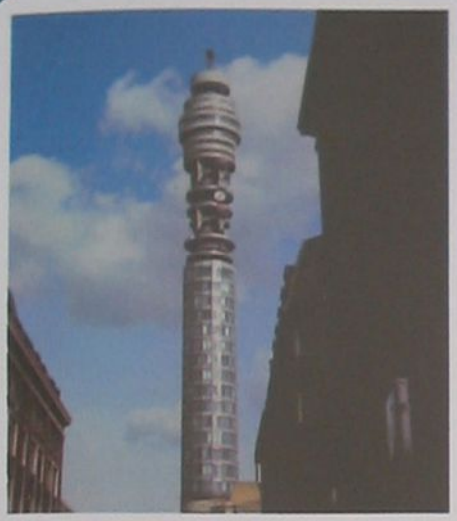
Amos works with Nikon F2As and Leicas when he is on assignment, using many lenses ranging from 16 mm to 600 mm. When photographing people, which is the greatest part of the work of a photojournalist, he usually uses 35 mm and 85 mm lenses. If he is ever restricted to a single lens, he prefers to take the 28 mm as he usually likes to set his subjects in some kind of context.

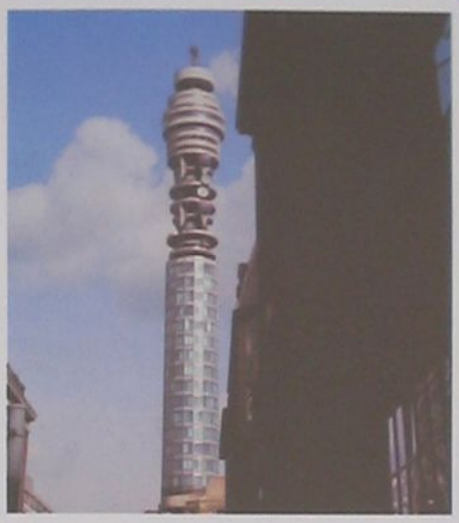
A great deal can be accomplished, he feels, with just one camera and one lens, particularly when he is photographing people. He uses strobes and motordrives only when it is absolutely essential—and never uses motors when photographing people. Since reportage photography by itself is, he feels, very aggressive, it is up to the photographer to keep the aggression to a minimum. With a motor, the photographer can sometimes give people the feeling that he is consuming them. And even though five or ten frames of a subject are needed, rarely do they need to be taken within fractions of a second.

What went wrong?

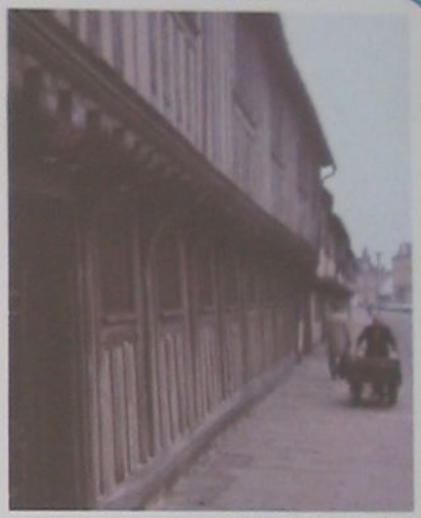
Photographing buildings

If you are disappointed with your photographs of buildings, you may find that many of the problems are associated with spending too little time on choosing the best viewpoints



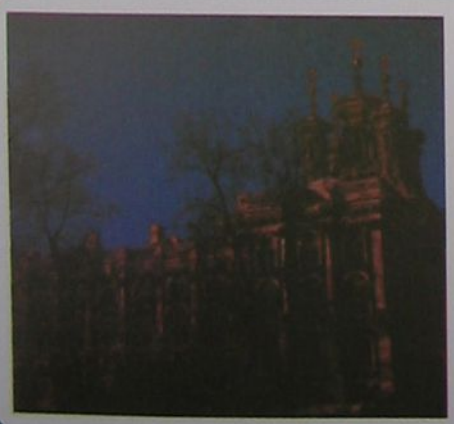


Two essentially similar pictures of the same subject—yet the first picture is far more successful simply because the photographer stepped nearer to the kerb to get more separation between the tower and buildings. The constricted composition of the second picture is typical of the snap as-you-see impulse photograph which turns out to be so disappointing on film. Always look for the best possible viewpoint

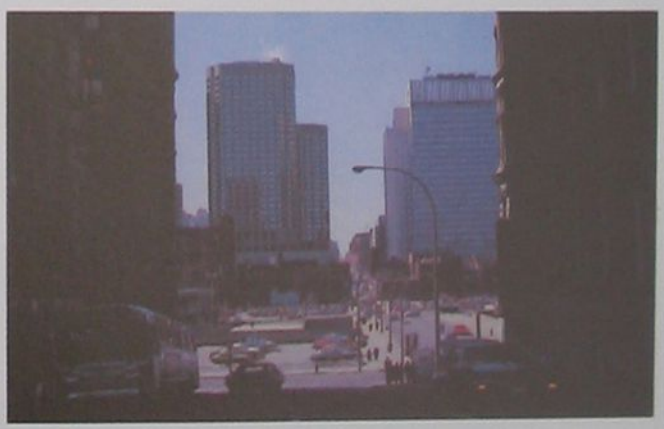


In an attempt to include figures within the picture, the photographer's chosen viewpoint shows little of this fine building's form and detail. A more square-on shot is needed

Strong side light creates an ideal opportunity for shooting fine structural detail. But the crammed composition of this shot is unsuitable as the detail is too dense to form a pattern. It would have been better either to include more of the face of the building, or close in for detail, as well as altering viewpoint



The photographer chose to override the meter by a full stop here, because he overestimated the reflections from the gilded roof—resulting in considerable underexposure. Where detail in a shot such as this contains abundant greys and equal areas of light and dark, you should rely on the meter



Towering sky-scrapers cut out much of the light at street level. On bright, sunny days this results in extremes of contrast between sky and street—and a real problem when you have to contend with murky shadows (left). Exclude sky areas from the picture, or use shaded buildings to frame your composition as shown (above)

'82 TRe LIK

David Hay/Tony Stone Associates

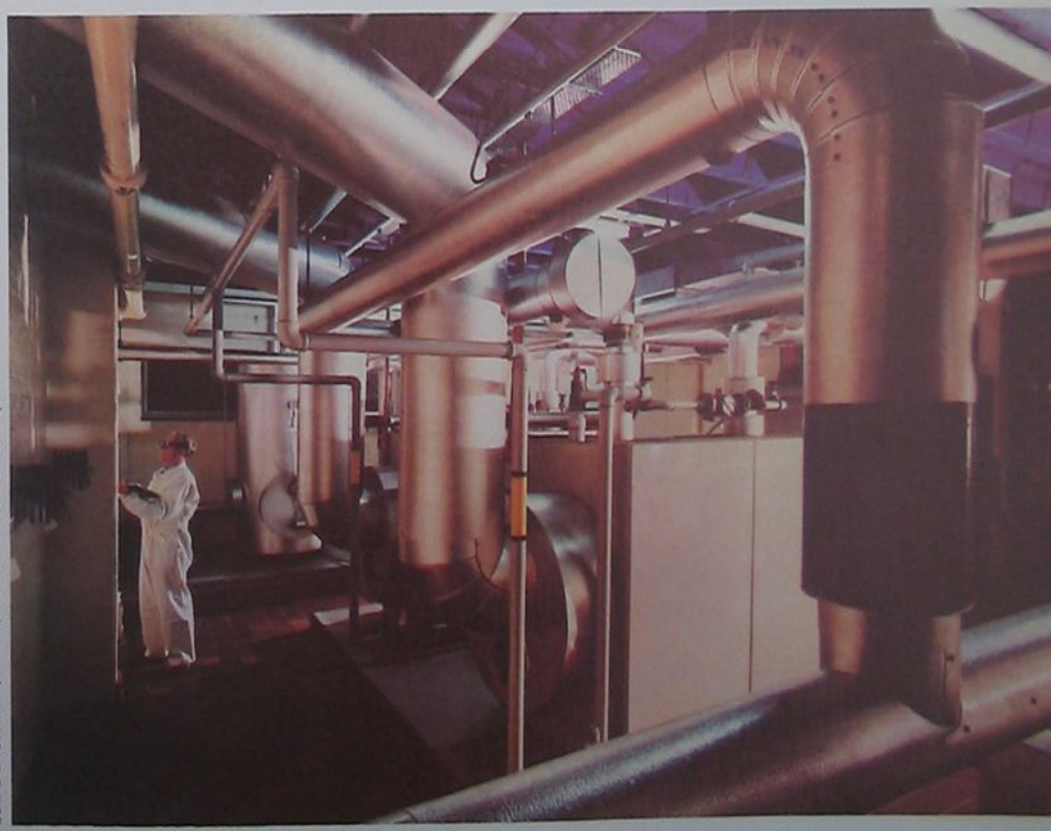
World of photography

Industrial photography

With subject matter ranging from dustbins to disposable cups, the industrial photographer's life is not usually glamorous—but it can be very challenging and varied, calling for a wide range of skills

Industrial photography is the poor relation of advertising photography. The fees and budgets are much lower and the subject matter is often less exciting. Instead of a gold necklace or a glass of wine, the industrial photographer must make the best of a forklift truck or an electronic component. But the wide variety of subjects—and indeed often their very ordinariness—makes the industrial photographer's life a challenging one.

At one end of the scale there are well financed in-plant photographic units and large photographic studios specializing in industrial work. These may use truck-loads of sophisticated equipment to cover a massive industrial development which also requires the differing techniques of technical, documentary and promotional photography. Such units provide their clients with hundreds of negatives and thousands of prints from a single assignment. At the



Len Dance, FIIP, FRPS/Rosser & Russell Group

Boiler room *Just two powerful flash bulbs, carefully placed, lit this boiler room at Lloyd's Registry. Light reflected off blue girders added colour. The man, essential for scale, was actually looking at a blank wall*

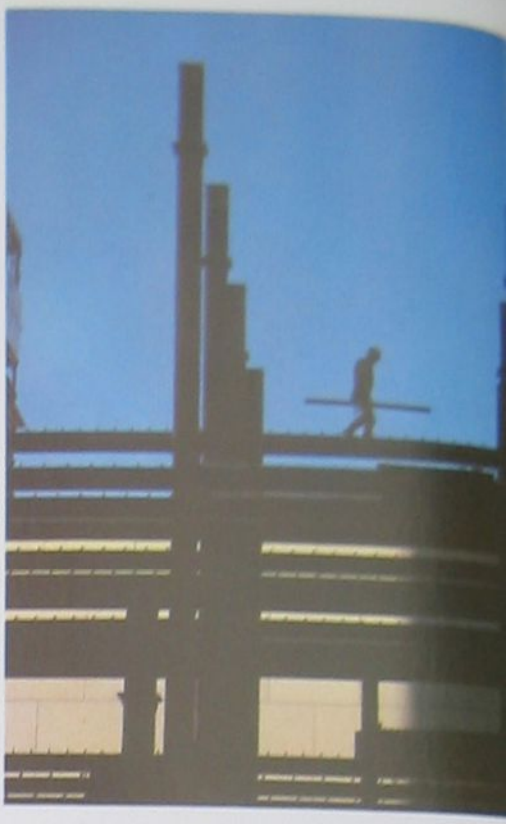
other extreme, there is the solitary freelance industrial photojournalist working with a minimum of equipment to produce a short, sharp magazine essay on the industrial pollution of a river.

Both aspects of industrial photography are often in evidence during a major industrial development. A good example of this was the building of the Aswan High Dam on Egypt's Upper Nile, which was to guarantee the farmers of the area a constant and controlled supply of water. Photography was needed at every stage of the process—from the initial site survey to the publicity operation at the completion of the project. A major engineering project, it required the services and products of scores of different firms. All of them wanted photographs—to document the work, to show to prospective clients, to include in their annual report and, more simply, to decorate their office walls.

The Aswan Dam project created a slightly more unusual need. The lake which was to be created would flood dozens of archaeological sites. As the building work progressed teams of archaeologists and photographers worked feverishly to uncover and document these sites before they disappeared for ever.

The dam also prompted some other types of industrial photography—those that looked at the project in a more critical way. Photographers who examined the social consequences of the dam's construction publicized two particularly negative aspects. The first was that the damming of the Nile also prevented the river's natural fertilizer, silt, from reaching the fields, so that the farmers had to spend money on artificial fertilizers. Secondly, the provision of a constant supply of water had the unfortunate side effect of increasing bilharzia—a debilitating disease spread by a snail that thrives in irrigation ditches. Photoessays in magazines and newspapers were at least partly responsible for prompting government action on these problems.

Few industrial developments equal the scale of the Aswan High Dam and most industrial photographers have to be content with far more modest assignments. Even so, a freelance industrial photographer running even a small business is still expected to have a range of skills and equipment that is demanded of few other photographers. Just as the nature of industry varies enormously—from giant steel-mills and shipyards to



Doug Wilson/Tony Stone Associates

On site *Silhouette shots are often used as they hide any foreground clutter and give simple images*

Humber bridge *Even on an overcast day, a shot taken at the right moment can appear spectacular*

microchips and disposable plastic cups —so the photographer must be equally versatile.

One of the most frequent problems an industrial photographer has to face is the fact that many industrial products are visually quite boring. Just how do you photograph a machine tool that has been sprayed matt black, or a tiny nickel-cadmium battery? Or the inevitable 'black box' designs of the electronics industry?

To overcome photographic nightmares like these successfully, the industrial photographer needs all the studio skills and visual imagination of an advertising photographer.

Ideally, the products will be brought into the studio to be photographed. Even so, there is more to the job than unrolling some coloured background paper, switching on a few lights and focusing. Each subject must be treated with as much care as if it were a top fashion shot. Skilful lighting is particularly important especially as many industrial components are made from metal or highly reflective materials. Some items can appear as confusing collections of machinery unless they are properly lit.

The photographer must also be very aware of the different ways of using lenses and viewpoints. A wide angle lens, for example, can make a fairly small machine seem like a towering skyscraper. If it is appropriate, there are other types of trickery which can be used—coloured lights or filters, multiple exposures and distorting lenses, for example. These can be used to varying degrees of subtlety. While a single blue light in an otherwise white light set-up can add a few interesting highlights to a machine, a shot which uses wildly contrasting colours, with starburst filters and other gimmicks, could well be considered excessive.

Indeed, many shots are intended solely as record shots, to show the product precisely and clearly for future reference. In such cases gimmicky lenses or lighting are not only unnecessary but probably unwelcome. What is often needed, however, is some sort of measuring scale so that dimensions can be taken directly from the photograph. When taking such shots, the industrial photographer is expected to have all the skills of a scientific photographer.

As an example of the care needed to photograph even a simple item, suppose that a photograph of a small piece of electronic circuitry is required. The way in which it is photographed, and even the equipment used, will depend on why the client wants the picture.

It may be that a straight, factual record of the circuit is all that is wanted. In this case a simple macro set-up will be enough. The circuit is mounted on a solid support directly below a vertically mounted camera (probably a 5 × 4 studio camera for maximum definition) fitted with a macro lens and a long bellows extension. As even the slightest vibration can completely ruin a close-up picture, both the camera and the subject must be securely mounted and a cable release is absolutely essential.

The biggest problem, however, is lighting. With the subject so close to the lens, the normal positioning of copy lights at 45° to the subject is impossible. The photographer must either use a ring flash, or must reflect light off a piece of optical glass at 45° to the lens axis (see page 1652). Either technique will give good, flat illumination which is ideal for a record shot.

However, a good photograph might be required for publicity, in both black and white and colour. In this case it would hardly be necessary to show every detail, but it might be important to show its tiny size in some way that would capture the viewer's imagination.

Len Dance FIIP FRPS/Agent Plant Hire

Giving a lift *A wide angle shot on a 5 × 4 Sinar plate camera makes the most of this forklift truck*

Paul Brierley

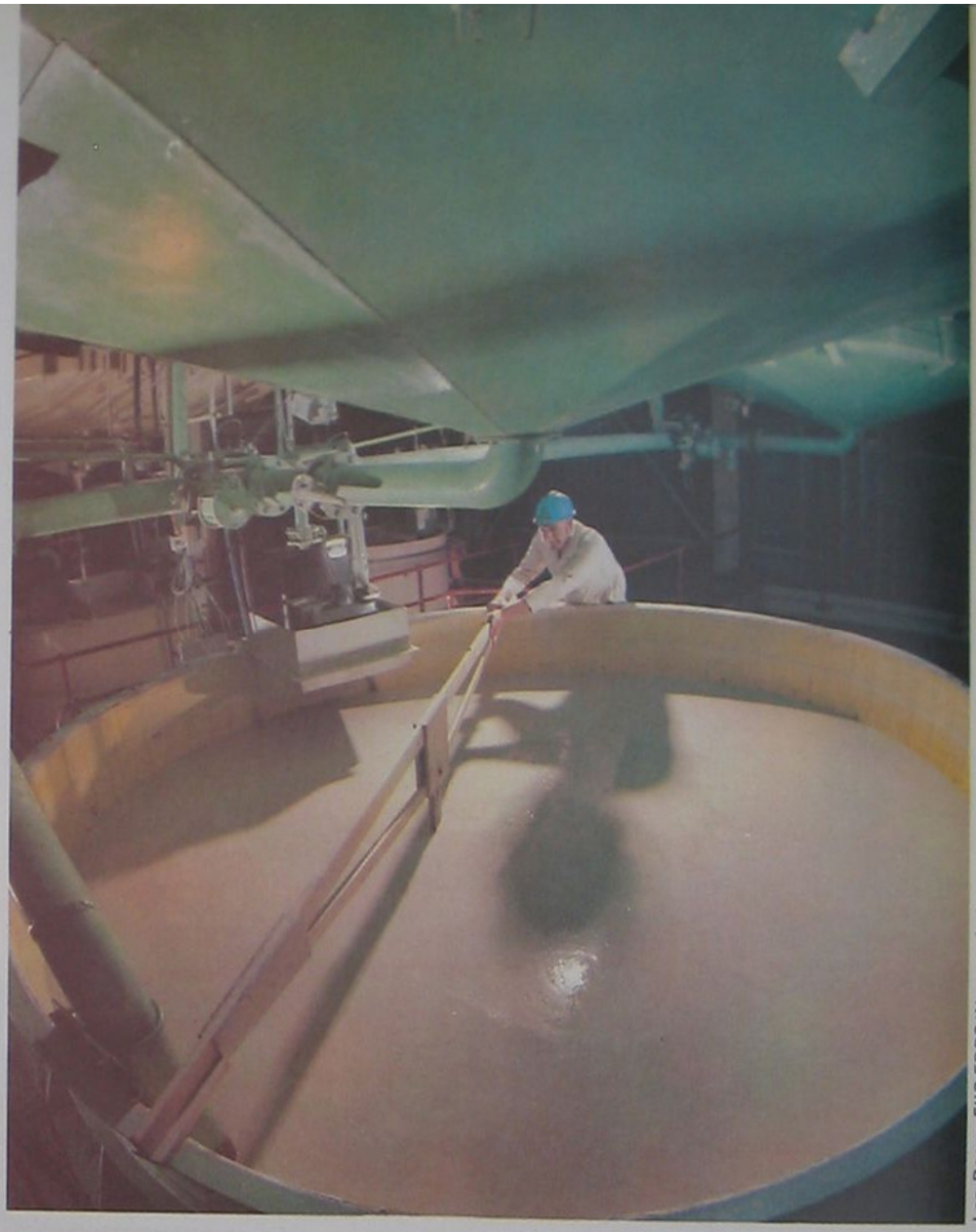
Microchip montage *This approach links a magnified view of the chip with its end product—computer screen output*

Although many everyday objects, such as matchsticks or coffeespoons, could be used to introduce this sense of scale, the most effective is probably the human hand with the circuit balanced on the tip of an outstretched finger. The psychological impact of comparing objects, big and small, against a human scale is very strong. With a good hand model and sensitive lighting, this simple idea could become an extremely powerful image. The photographer or art director might even decide to use a baby's hand, not only to show the smallness of the electronics, but also to imply that this is the industry of the future.

While studio work allows the photographer to use plenty of equipment and imagination, it is in location photography that the widest variety of challenges are to be found. As well as the obvious tasks of photographing machinery or installations in use, the photographer may be called on to do almost anything in order to achieve the right picture. Not only photographic skill but good nerves are sometimes needed. Someone might decide that their factory should be photographed from the top of a nearby chimney or crane, for example—and it will be the photographer who has to make the ascent with the right equipment in whatever conditions may apply on the chosen day. And photography from the air is commonplace, so it may also be necessary to sit with legs dangling out of the side of a helicopter, or in a jet fighter.

The fundamental problem on location work is still usually the same as in the studio—how to make an interesting and appealing picture of an apparently dull subject. Again it is the photographer's inventiveness that will create the shot—perhaps using a wide angle to emphasize the scale of the machinery or framing tightly with a telephoto so as to give a feeling of a worker's concentration and skill in carrying out a task. As in the studio, careful use of lighting together with portable coloured or black backgrounds can give real impact to a shot as mundane as someone polishing the front of a television tube in a factory.

In the studio, a photographer can generally work undistracted, even when up against a tight deadline. But on location the conditions can be truly nerve-shattering. Time is money in industry and a company can rarely afford to stop production simply because someone is there taking pictures. The photographer may have to work quickly, accurately and creatively amid the noise, dust and fumes of a busy factory. While setting up equipment in cramped surroundings it is necessary not to get in anyone's way, yet still to be the perfect diplomat. Maybe the company director must be persuaded to provide more time to get something more interesting than just a straight record shot or the machine operator needs convincing that it really is important that he puts on a clean overall and waits for another five minutes so the lights are positioned in exactly the right places.



Len Dance FIIP,FRPS/Norcros Ltd.

Vat man *The lighting—six electronic flash units—took 2½ hours to set up. The unit which casts the man's shadow across the slip (for tile making) was hung from string behind the hopper*

The strain on the photographer's concentration in such circumstances is considerable. Even the best of them tell of times when they were so absorbed in setting up the lighting, choosing the best camera angle and calculating the exposure that they completely overlooked the dirty oil can or the packet of sandwiches in the corner of the frame. Overlooked, that is, until the film was processed, whereupon such out-of-place details became glaringly obvious.

Given the diversity of subjects and uses of industrial photography it is hardly surprising that an industrial photographer must have a comprehensive range of equipment, from heavy studio cameras to motor-driven 35 mm SLRs. As crisp, fine detail is usually important in industrial photography, a great deal of work is done on medium and large formats, using 5 × 4 or 10 × 8 monorail and drop-bed cameras. These may include the Sinar or Linhof, whenever control of perspective and depth of field is vital, or a 6 × 7 or 6 × 6 roll film camera, such as the ubiquitous Hasselblad, when faster, more spontaneous shooting is called for.

Location work requires great skill in lighting—and there will be occasions when a great deal of it is needed. The sheer size of many factories and assembly lines is daunting. Available light is rarely sufficient or of the right colour temperature, which is one reason why some photographers still use the old-fashioned flashbulbs. Even though each bulb can only be used once, the outlay on equipment is still relatively cheap and the lamps weigh much less and are easier to position than either tungsten lamps or electronic flash heads for the same volume of light.

Positioning the lights is crucial. Neither the lamps nor their cables should show up in the photograph. Equally importantly, the areas of light and shade created by the lamps should not conflict with those created by the main light source—daylight. Positioning lights can take several hours so it is essential to have an assistant. The photographer can judge the effects created by the lights from the camera position. Directing the assistant across a large area of factory floor can be a bit of a problem, so some

industrial photographers pack a megaphone in with the rest of their equipment. This is also useful for directing workers in a photograph once everything is ready to shoot.

As in the case of electronic components, human scale is important when photographing large pieces of machinery. The giant earthmovers used on big construction sites are truly massive, yet they are still controlled by people and work for people. It is important to bring this out when photographing them. Even so, it is not enough to simply set up the camera and shoot. Construction sites are untidy places, and a certain amount of cleaning up and preparation is necessary. A few minutes with a steam-cleaner removes oil and mud from machinery or vehicles, but it is best not to make them look too clean, or they begin to look set up. Photographers usually make tyre walls appear a deep black—scruffy tyres immediately make any vehicle seem old and ill-used. A stiff brush and some black shoe polish can work wonders. One enterprising photographer also carries some brightly coloured safety helmets in the boot of his car as optional headgear. In the printed picture bright splashes of colour instantly draw the viewer's attention.

Although photographers usually photograph industrial vehicles in daylight, natural light is not always ideal. Direct sunlight produces harsh, deep shadows that may hide important details. Even softly diffused daylight on its own can be difficult. Large reflectors made from white fabric that can easily be folded and stowed away are very useful for filling in shadows on location, as is a small, low-powered flash gun. The low power of the flash will not compete with the daylight, but merely lightens the shadows a little.

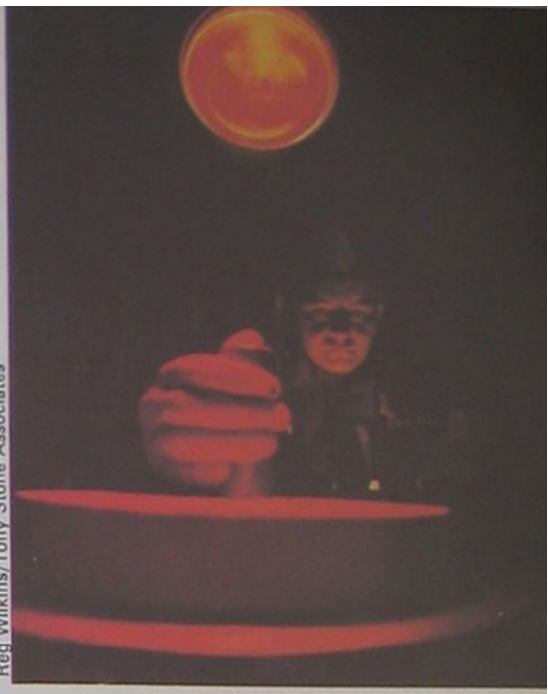
Some companies have their own photography units, equipped with studio, processing facilities and darkrooms, while others rely on outside freelance industrial photographers. If there is a large amount of specialist photography to be done, in-plant photographic units can provide and develop the skills needed. But, equally importantly for the company, the photographers will understand the company's needs and products. And if the photography is of a new prototype in a highly competitive market, the company also has a greater guarantee of secrecy if they use their own photographers.

It used to be said that in-plant photographers were a rather unimaginative breed, always behind the times and out of touch with current styles and techniques. If that were ever true, it is certainly not so today. Photography is too expensive and the competition among good photographers too fierce for any company to put up with less than the best from their staff photographer.

One multinational motor manufacturer employs a team of five photographers in one country alone. When it is time to do the publicity shots for their latest range of cars, they fly the cars, the models, two or three photographers plus all their equipment to some suitable exotic location for a couple of weeks. All this must be done in secret, to keep their competitors guessing. Any staff photographer who makes a mistake on such an assignment is very quickly going to find himself looking for another job.

Len Dance FIIP,FRPS/Cementation Ground Engineering Ltd.

Drilling *The red helmet was provided by the photographer, who used three flash units to light the gloomy site*



Reg Wilkins/Tony Stone Associates

Grinding *In this case, coloured and unusual lighting adds some drama to an otherwise dull subject*

As well as those photographers who are paid by industry, there are others who document the social problems raised by industry. Their task is quite different from that of their colleagues, for it is frequently responsible for changing public opinion concerning the excess and effects of industry. A classic example of this was the crusade of American photographer W. Eugene Smith in the 1960s in Japan. For years a factory there had been dumping mercury and other poisonous wastes into a river that flowed through the village of Minemata. Smith documented the way in which this poisoned supply crippled many villagers, causing some to die in terrible pain.

Despite being repeatedly threatened by the company and even beaten up by some of its agents who smashed his cameras, Smith persisted. His pictures compelled the world to take notice of what was happening in Minemata, and the company was eventually forced to accept the villagers' demands. Since then, virtually every country in the world has legislated against the dumping of mercury.

Photography, then, is a tool which can be used to suit the needs of industry and to prevent its excesses. It is a field which many overlook when considering the profession of 'photographer'. Yet the whole world depends on industry, and industrial photographers play their part by providing an essential service.

Lighting close-ups

Tiny, close-up subjects require careful lighting if they are to be shown to best effect. And at the short subject-to-camera distances involved some special techniques are required

David Parker

Rhinoceros beetle *In overcast weather, when shadows are gentle and soft, natural daylight may be all you need to light close-up pictures*

Fungus in focus *In most cases, however, some extra light is necessary. This mushroom was lit using a single flash unit on the right, with a reflector card opposite to fill in the shadows*

Small subjects present the photographer with special lighting problems, because when camera and subject are very close together, seemingly tiny patches of shadow are often enlarged until they fill half the picture. To combat the high contrasts and loss of detail that can spoil close-up pictures, you need to light your subject even more carefully than usual.

Outdoor close-ups

Natural daylight is one of the most convenient light sources—it is usually quite bright and, unlike electronic flash, it provides continuous illumination, so it is easy to see how the subject is lit. For these and other reasons, many photographers take their first close-up pictures out of doors, often of a natural history subject such as a flower.

Despite its advantages, however, daylight has some drawbacks as a means of illuminating small objects. For one thing, it is difficult to control, and if you are working out a trip in advance it is impossible to predict whether you will be working in sunny or overcast conditions. In brilliant sunlight the strong shadows may help you to bring out a sense of depth in a subject, but in close-up work you must make sure that important detail is not obscured by heavy shadow. If this seems to be a problem there are two possible solutions—either you can wait until the sun is covered by a cloud, so there is a much softer light, or you can control the sunlight by the careful use of reflectors and diffusers.

For this purpose, it is worth carrying several pieces of white and grey card each about 20 - 25 cm. If you frequently take close-up pictures outdoors. A diffuser can be made from a sheet of tracing paper or acrylic lighting gel which is more durable.

Both reflector cards and diffusers are used outside the picture area to direct light into the shadows of the subject and reduce the overall contrast of a picture. Diffusers are used between the light source—in this case the sun—and the subject to provide an even, less directional source of illumination than direct sunlight. A reflector card can have an even more dramatic effect, and can lighten shadows considerably. White card is useful for this purpose, but a card covered with crumpled kitchen foil is

Single flash *The simplest form of lighting is a single flash directed straight at the subject. This produces heavy, well defined shadows and relatively harsh modelling*

Diffused flash *A cylinder of tracing paper around the subject, lit by a single flash, improves the lighting. But it can sometimes eliminate the highlights, producing a dull result*

Twin flash *Flat objects such as stamps can be lit by two undiffused flashguns. Three-dimensional objects, however, cast harsh shadows, and this method of lighting may not be suitable*

David Parker

often more efficient. Its many faceted surface reflects light in a similar manner to a sunlit pool of water. Flat silver card tends to have a very directional effect if used in bright sunlight, producing a very unnatural appearance, and it is unwise to use this or coloured reflectors unless you have a very clear idea of the effect you are trying to achieve.

Reflector cards can also be used as neutral backgrounds, but if you use white card as a background when photographing a small subject such as a plant, remember that the reflective surface of the card also affects the overall lighting. It introduces an element of diffuse backlighting, and the apparent transparency of the flowers or leaves is changed. The effect is less noticeable with a grey or coloured card.

Although direct sunlight presents the photographer with problems of harsh shadows and burnt-out highlights, not all outdoor subjects are found on exposed ground which is reached by the direct rays of the sun. Fungi, for example, often grow in dark, dank woods where even on the sunniest day the light is dim and diffuse. This means that the outline of the plant can easily disappear into a leaf covered background unless some additional lighting is used. There are exposure problems, too, simply because the light is so dim, and because depth of field considerations require the use of a small aperture. Even with a tripod and fast film, available light photography may not be feasible. In such cases, the most satisfactory solution is to use an electronic flash unit, and to control it so that the flash is used as the main light with daylight as fill-in.

The commonly available computer type unit is best avoided for close-up work, and the smallest, cheapest manual gun is almost certainly adequate for most requirements. A very powerful flash may actually prove difficult to use, and a weaker flash makes it easier to strike a balance between flash and natural daylight.

Whatever flashgun you use, it is essential that you are completely familiar with its power output and method of operation, so that you can predict the precise effect and determine the exposure accurately.

Using flash and daylight in combination takes some practice, and although there are some circumstances where direct flash on camera is acceptable, it is more likely that you will need an extension lead to allow you to use the flash unit well away from the camera. For example, when photographing a toadstool deep in a wood, flash on camera would give very flat illumination over a limited range, with a totally black background. More natural lighting is produced if you try to simulate the quality of light that would fall on the toadstool if it was growing in an open spot in sunlight. In the open, sunlight would fall on it from above and to the side so you should place the flashgun in a position which reproduces this kind of lighting.

In this case, you should direct the flash so that it is at about 45° to the camera axis in both vertical and hori-

David Parker

Bright flower *All types of lighting must be used with discretion. Axial illumination (bottom) eliminates shadows but colours are richer when a single direct flash is used (top)*

A hole for highlights *By cutting a hole in the cylinder of tracing paper that surrounds the subject, some of the flash falls directly on it, to give a more sparkling result*

Ring flash *The shadowless illumination that makes ring flash so suitable for heavily textured subjects can actually be a disadvantage in some circumstances, flattening out important detail*

David Parker

Axial lighting *can sometimes be useful for illuminating particularly difficult subjects, and is ideal for objects that have reflective surfaces at odd angles*

Spider and moth *For this picture, flash was diffused by bouncing it off a piece of white card, which was held directly above the spider and its prey*

Diffuse lighting *A simple and effective way to light a small subject is to surround it with a cylinder of tracing paper, and light this from the side*

David Parker

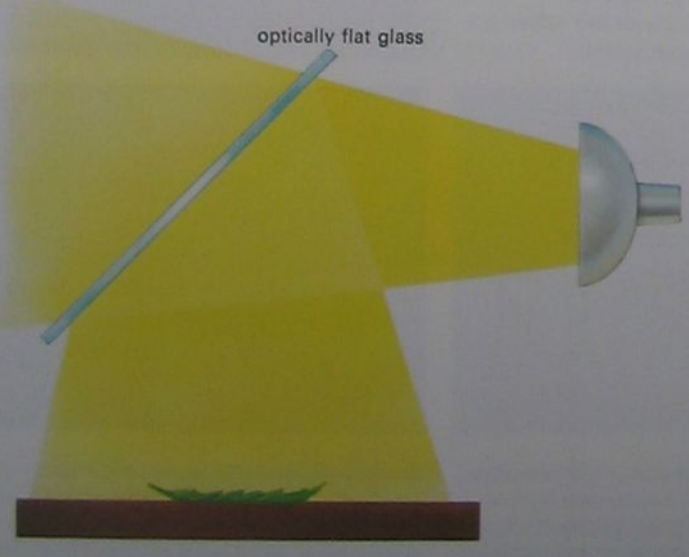
zontal planes—similar to conventional portrait lighting. This reproduces natural sunlight, but unfortunately it also brings with it the same problems of deep shadows that you encounter when using sunlight as a light source. One solution to this is to use reflectors and diffusers to fill in the shadows formed by the flash, but by using a long exposure, you may be able to use the daylight itself to brighten the dark shadows and reduce the contrast of the subject.

This is done by carefully balancing the exposure for flash with that from the daylight. The aim is to give a normal flash exposure combined with a daylight exposure one stop less than normal. This will give twice as much flash as daylight, so the daylight will fill in the shadows.

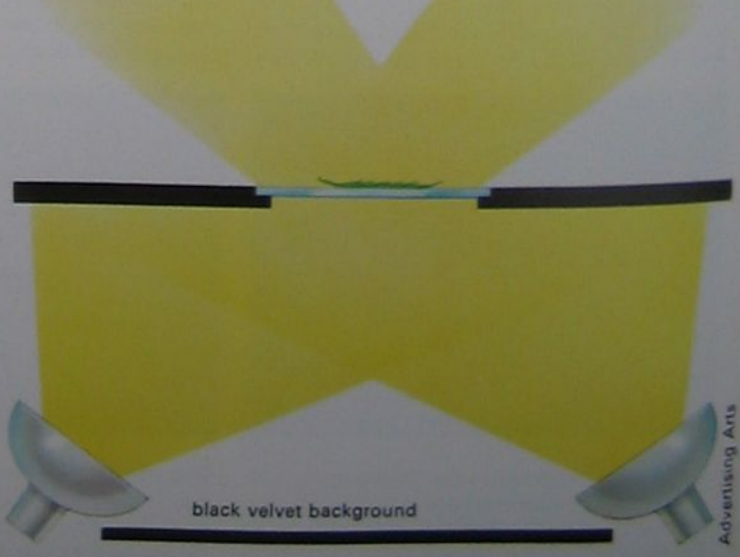
The first step is to work out the aperture required for the flash exposure. If you have an automatic unit which will work at close distances you can use the aperture it recommends on the table on the side or back of the unit, but remember that if your flash unit is at a angle to the line of sight you will inevitably lose some of the effect of the flash. With a manual gun you will probably need to know the guide number, since the tables on the units rarely cover very close distances. If you do not know the guide number, work it

Special techniques

Axial illumination



Darkfield illumination



Advertising Arts

out from the table by multiplying any flash-to-subject distance by the aperture it recommends. Use this GN to find the aperture for the actual subject distance. This will be your working aperture for the shot.

Next, find the shutter speed required for the daylight exposure by opening up by one stop from the working aperture and taking a reading. Remember to stop down again to the working aperture before taking the shot.

This procedure results in a flash to daylight ratio of 2:1, and though this is fine for colour materials, a ratio of 4:1 or 8:1 is better for black and white materials whose contrast can be controlled in printing. Greater contrast between the flash and fill-in is achieved by taking the daylight exposure reading at a proportionately wider aperture, before stopping down as before to the working aperture. Do not forget that if you are using extension tubes or bellows, a reduced amount of light reaches the film, and you must compensate for this as shown on page 833.

Close-ups indoors

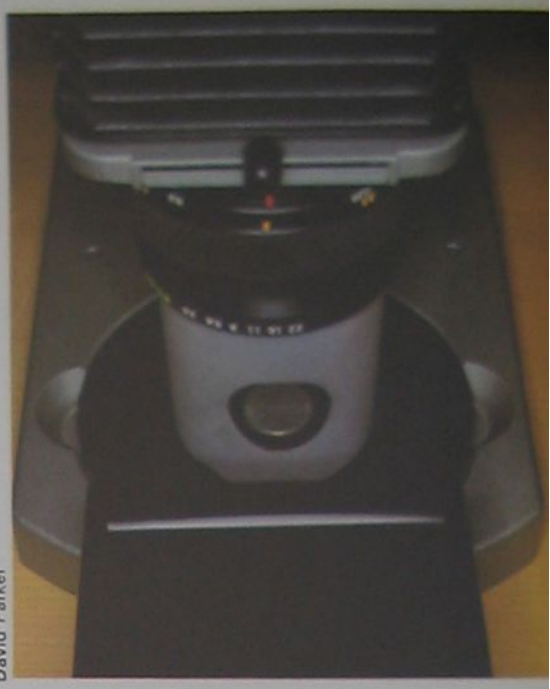
Certain types of subject require close-up photography outdoors, but most small objects can be brought indoors and shot in the studio. This eliminates the inconvenience of carrying bulky camera gear out on location.

Elaborate equipment is not necessary for close-up lighting indoors. Because such a small area is being photographed, low power flash or tungsten lighting is all that is needed. A simple lighting set-up might consist of one lamp, a couple of white reflector boards to fill in the shadows, and a few small mirrors to add sparkling highlights.

The first decision to be made is whether to use flash or tungsten light. Tungsten is easier to control, but heats up small subjects rapidly, and requires either tungsten balanced colour film or heavy filtration. Electronic flash, on the other hand, can be used with the more widely available daylight balanced film, but makes it more difficult to see what the final result will look like.

To get round this problem, professional studio flash units incorporate modelling lights, and you can simulate the effect of these on a simple level by setting up the shot using a small reading lamp as a light source, then replacing it with a flash unit immediately before exposure. The effect of the flash is likely to be slightly different, but this technique can still provide a useful guide if you are using only one light source. With more than one, it may be difficult to match the output of the flashguns and tungsten lamps.

General lighting techniques indoors are very similar to those outdoors when it comes to the placement of lights and reflectors, but a studio allows even greater versatility. This is important when extremely soft lighting is required —when the subject is very shiny, for example, or when it has a deeply convoluted surface which casts heavy featureless shadows.



David Parker

More sparkle *With reflective subjects, diffuse lighting may be too dull. Holes cut in the diffuser add highlights, and black card inside puts in shadows*

A cheap and simple way of providing this flat lighting is to surround the subject with a cylinder of tracing paper, then shoot from one end. You can create soft but directional lighting by using only one light source, at one side of the cylinder, but by using two lamps—one on either side—you can make the lighting completely even. For really tiny objects, use a clean white eggshell instead of a tracing paper cylinder, and for larger ones, construct a tent out of thin white fabric and light this in the same way as before.

Sometimes, these techniques provide light that is too flat, particularly if you are photographing a small reflective subject. To add bright highlights, make a hole in the diffuser which surrounds the subject. Light from the lamp can then be shone on to the subject, either directly or by using mirrors. 'Shadows' can be created by putting strips of black paper or card inside the diffusing enclosure.

When very flat lighting is required for a non-reflective subject, a useful if expensive option is ring flash. This provides completely shadow free lighting by effectively bending the flashtube —in a suitable reflector—around the front of the camera lens. The quality of light produced by a ring flash is ideal for an objective, precise record of a small subject. This has led to it being widely used by medical photographers and for other scientific purposes, but for many subjects the effects it produces are too flat and lacking in depth. Unless you have very specific reasons for using ring flash, it is better to stick to more conventional methods, and deal with each and every close-up lighting problem on its own merits.

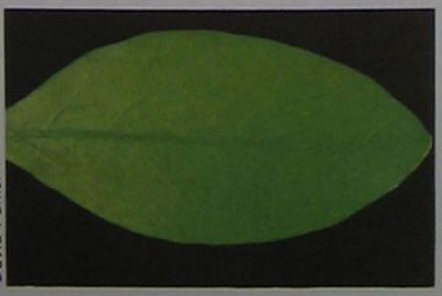
Some subjects demand special treatment, maybe to emphasize their texture or their transparency. To bring out detail in shiny, textured objects without creating burnt-out highlights, you can use an effect called *axial illumination*. This completely shadowless form of lighting is produced by arranging the axis of the lamp and that of the camera lens so that they lie at right angles to each other. A sheet of flat picture glass is set at 45° and reflects the light down on to the subject.

The reflection of the light is only partial, because most passes straight through the glass sheet, and you should take this into account when calculating the exposure.

For translucent objects, *darkfield illumination* is particularly useful. The subject is placed on a sheet of glass at a distance from a black background, and backlit in such a way that the lamps do not shine into the camera lens. The subject then appears to be floating in space, and glows brightly against a solid black background.

If you decide to try this technique, you will undoubtedly find it easier to master if you use tungsten lighting rather than flash. You must also take great care to prevent dust from falling on the glass plate, as every speck will be picked up by the bright backlighting.

Darkfield illumination *A method for bringing out detail in translucent and semitransparent objects. The specimen is supported by a sheet of glass, with a sheet of black paper or fabric behind. The glass is lit from below by flash or tungsten light*



David Parker

From tone to line

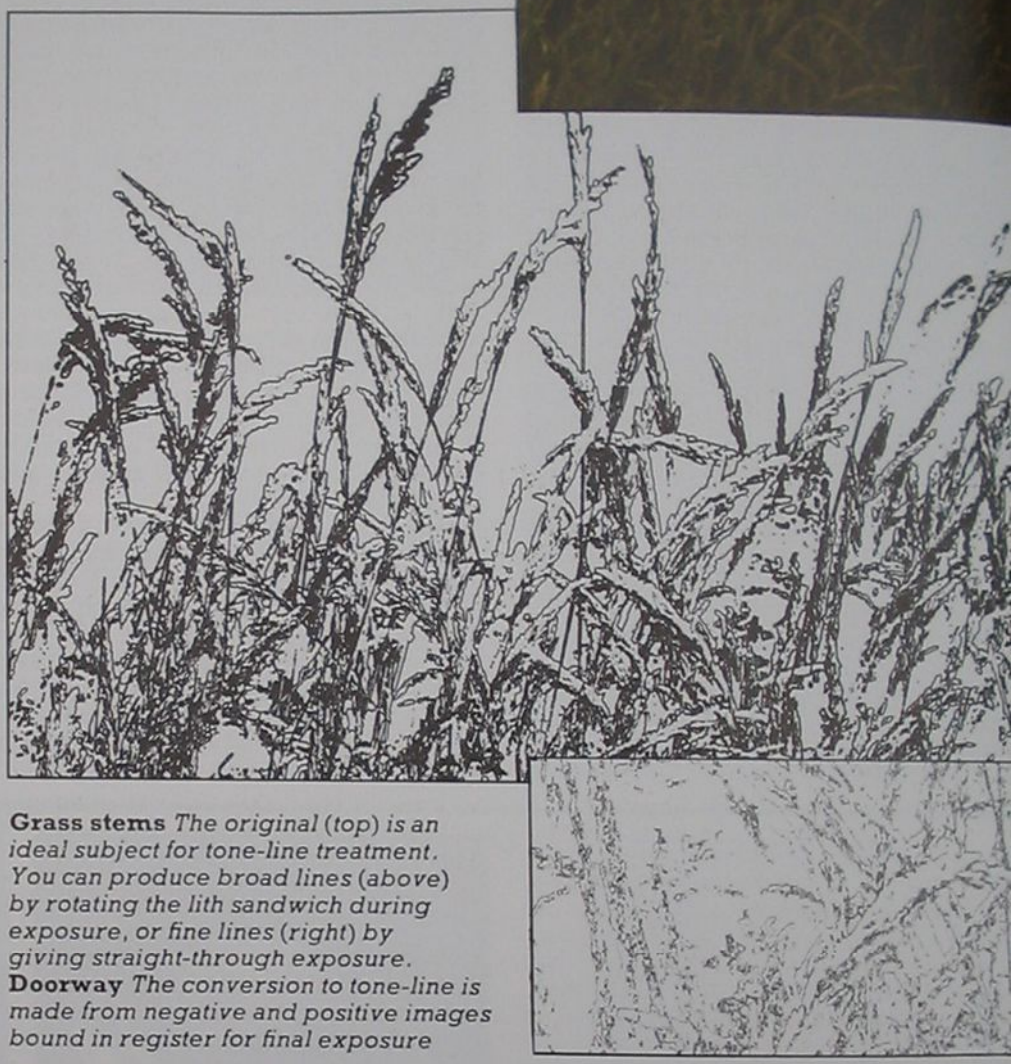
You can give any photograph the appearance of a finely etched engraving with a straightforward darkroom technique using lith film

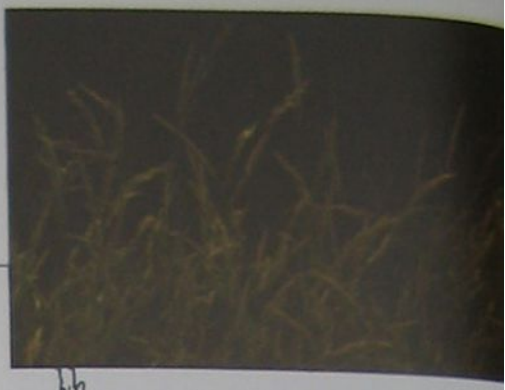
If you want to make pictures that look like original drawings based on your own photographs (see pages 1634 to 1637), but are put off by the freehand pen tracing line work involved in many of the processes you can use instead purely darkroom techniques to achieve similar results.

Particularly interesting pictures of this type can be made by using a technique called tone-line. This produces images of continuo s line, and tone, in negative form—which means you can produce any type and number of positive images quickly and easily.

The drawing effect is produced by exactly matching negative and positive images of your original negative or slide and using the combination to print the final image. This is how a bas-relief can be produced (see pages 1208 to 1211). But the difference of tone-lihe is that, viewed normally, the combination is virtually a uniform shade of grey or black which lets little or no light pass through in normal contact printing.

If, however, a lamp is shone obliquely at the sandwich, the physical separation of the negative and positive images, resulting from the thickness of their film bases, allows image forming light—in the form of a line—to pass through. But the full conversion of a continuous tone original to tone-line is only possible if the negative and positive elements cancel each other completely. Further, the line effect caused by an oblique lamp will cause a one-sided line effect





Grass stems *The original (top) is an ideal subject for tone-line treatment. You can produce broad lines (above) by rotating the lith sandwich during exposure, or fine lines (right) by giving straight-through exposure.*
Doorway *The conversion to tone-line is made from negative and positive images bound in register for final exposure*

unless the lamp—or, more usually, the whole contact printing set-up—is rotated during the printing exposure.

Negative and positive masks

The first stage is to produce a set of negatives and positives from your original photograph. Much of the success of this technique lies in correctly aligning these intermediate images. To do this is difficult with 35 mm so it is worth working with intermediates which are enlarged to the final image size. If you have a large format enlarger, you may find it more economical to work to an in-between size and then enlarge the final negative. This gives you a little more flexibility when it comes to producing prints in various sizes.

Choose an original which looks as if it will respond well to the tone-line treatment and make either a positive or a negative from it, depending whether it is a negative or a slide.

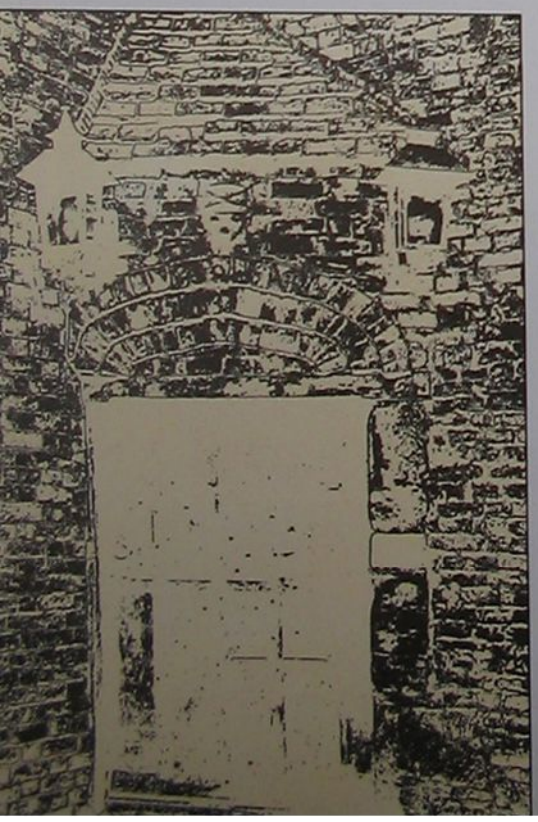
Contact this on to the same film previously used to make the corresponding positive or negative of your original. For clear-cut lines you will find that line or lith film is best to start with. You can use continuous tone material for the masks but special care must be taken to match contrast and density of the negative and positive halves of the combination or some tone will show. While this can be exploited to obtain an interesting combination of tone and purely line effects, entire elimination of tones calls for a good deal of trial and error in exposure.

Next, bind together the negative and positive halves of the combination, film base to film base, so that the two emulsion sides face outwards. Register the images exactly over a lightbox, and tape one to the other using masking tape as this can be removed without damaging the films. If you do not have a lightbox, tape one side of the combination to a piece of glass. Place a sheet of white paper behind this and reflect viewing light on to the back of the glass. Carefully register the second image and then tape this to the glass as well, along the same edge. The glass with both images attached can then simply be flopped over for printing. But if you do this, make sure the images are correctly orientated and that the glass is clean.

Carol Christopher

Store front *This colour posterization was made by exposing black and white tone separation negatives through coloured filters on to colour printing paper. Over this, two tone-line images (left) were printed in light and dark blue to provide detail key-lines.*

Children *Two sets of tone-lines were produced by combining two pairs—such as the mid tone neg and pos—used to print the basic tone separation. Printing the tone-lines on the latter gives areas of tone separation by lines*



Using a punch system

For sheer convenience, use a punch register system. Alternatively, you can make one (see page 927). Size up your original image in the normal way, punch a sheet of film and—if necessary—back this with a sheet of black card to eliminate reflections from the enlarger baseboard beneath the film. Place the film over the register pins, print the first image, and process the film as usual. Punch a fresh sheet of film and place this emulsion upwards on the register pins. Place the first image emulson downwards on the register, weight the combination down with a sheet of glass, and make an exposure to white light from the enlarger. Remove the lower film and process this to obtain the second image. When this is dry—a matter of minutes if you use heat drying and lith film—simply slip a fresh sheet of punched film into position on the register pins, and slip on the first and second images.

With a register pin set-up, the whole business takes next to no time up to the final printing stage, and avoids the frustration and disappointment of poorly

Carol Christopher

registered images which can easily result if you have to rely on manual alignment.

Rotating lamp or stage

The sandwich consisting of unexposed film and the two (negative and positive) images is then exposed to oblique lighting. One way of doing this is to suspend a bare opal or frosted bulb a little to one side of the contact printing set-up, at about 45° to the centre. During exposure the lamp is moved in a circular path around the contact printing set-up so that it makes one complete revolution, or complete multiples, during the course of each exposure.

This arrangement does pose problems and many workers prefer to use an alternative method which uses a fixed bulb. Position this some distance from, and at 45° to, the contact printing set-up, as before. During the course of an exposure, the printing set-up is carefully rotated for one complete revolution or multiples. This step need not be very precise and you may find that the results are perfectly acceptable using a contact printing set-up arranged on a separate board which you can carefully move during exposure. But for larger printing set-ups—especially if constant line width is required in the eventual tone-line—some form of rotating platform is advisable. You may be able to adapt an old gramophone turntable for this purpose, but a cheaper alternative is a rotating cake icing tray. In each case, use a suitably sized disc of black card placed between the film and its support to cut out reflections which may affect the

Rotational exposure *Much of the success of a tone-line depends on the uniformity and repeatability of the all-important exposure of the combined negative and positive images. Of the three methods shown here, the first tends to be the most successful—and is most smoothly achieved by using a turntable. Take care not to dislodge the glass-film sandwich*

1 *If you use lith for the first stage negative (or positive), establish the extent of tone elimination by tests*

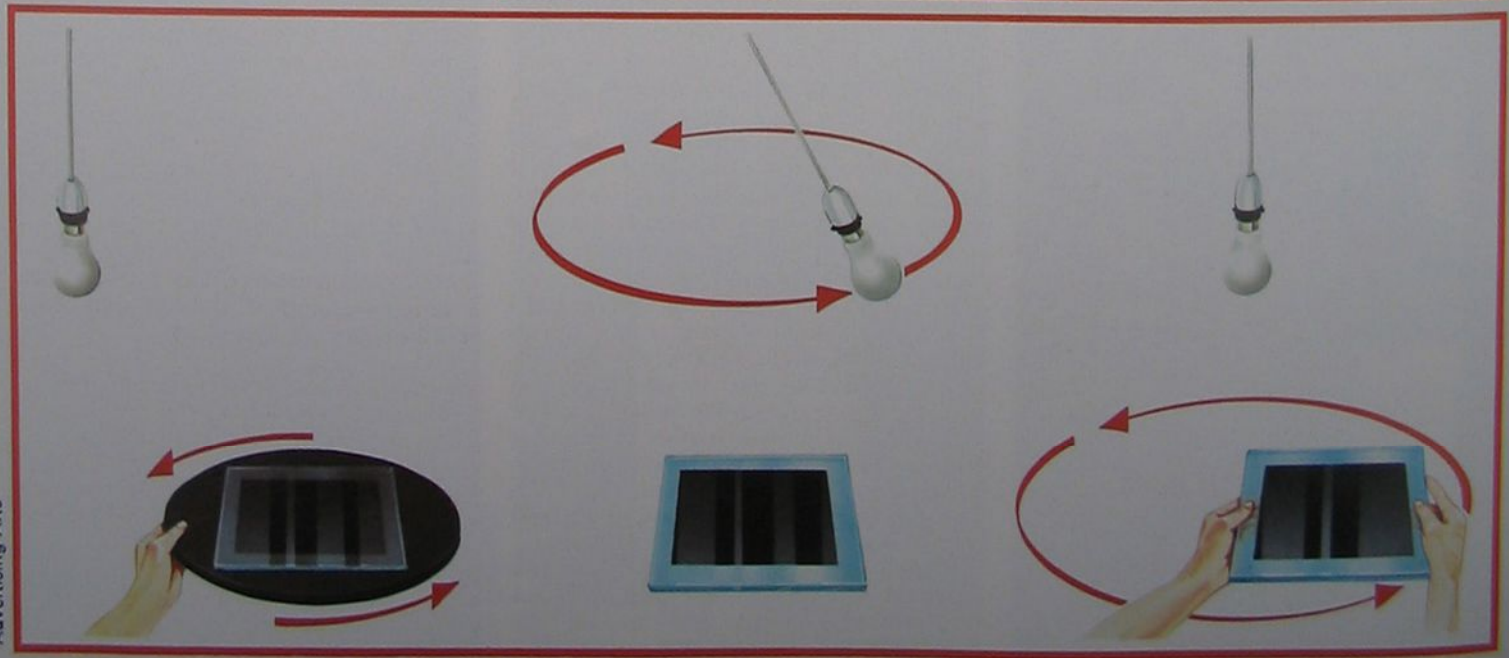
2 *Then make the negative (or positive). The amount of exposure is critical. Ensure consistency by using fresh developer*

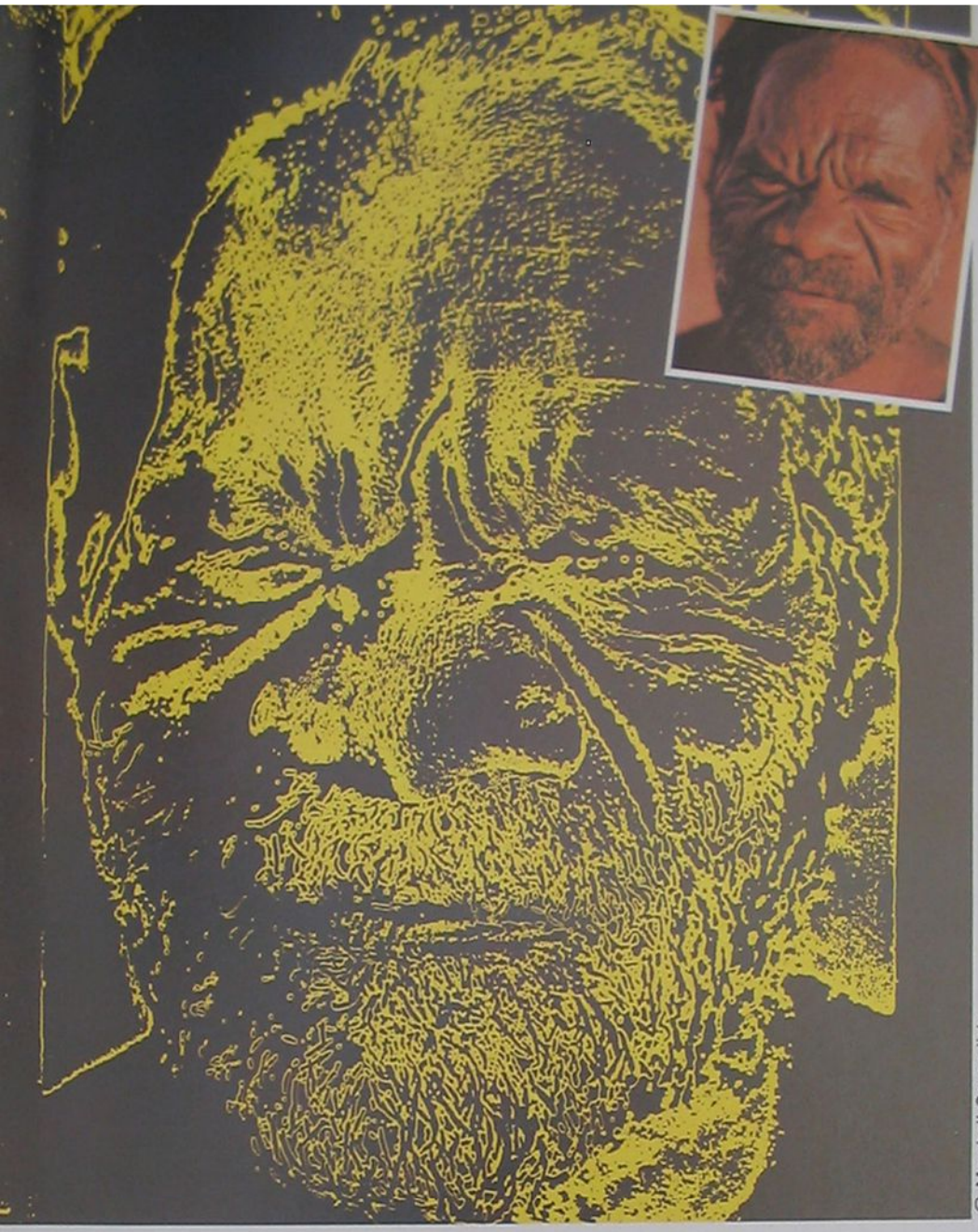
3 *Carefully spot out any pinholes in the negative (or positive) and make a reversed copy by contact printing*

4 *Compare negative and positive 'halves' of the original image and retouch—in the black areas—all surplus or messy detail*

5 *Carefully tape negative and positive parts of the combination together, exactly in register, viewing from above*

6 *Complete final retouching (blocking out), viewing from above and the sides, before exposing the tone-line*





© Marshall Cavendish

unexposed emulsion during exposure. While rotating the set-up during exposure, be careful not to dislodge the glass/negative/film sandwich or multiple line images will result.

Exposure variables

The exposure you give depends mainly on the lamp power and its distance from the contact printing set-up. Ideally use a fairly bright bulb of 60 W or 100 W placed a metre or so to one side of the set-up. Establish the correct time by trial and error, remembering to keep your bulb or lamp at a constant distance. Use 10 seconds as a starting point. The longer the exposure time, the broader the resulting lines will be as a result of irradiation in the film.

Because of the penetrating qualities of an exposing light of this type, take special precautions to make sure that boxes of film and paper are safely sealed up during each exposure—well away from the light source.

When you have established the correct exposure for one particular tone-line sandwich, it should remain good for all subsequent tone-lines made using the same materials.

The resulting tone-line image is processed and printed just like any other negative. Interesting variations can be obtained by applying posterization and solarization techniques at this stage, first to reduce the amount of detail even further, and second to accentuate lines which now outline all the details of the original image.

Yet another use for a tone-line image is to combine it with its original. This can be done simply by mounting the two images together, or by successive printing using a system of registering the two images, as for colour posterizations (see pages 1180 to 1183).

Retouching

If you are using lith film for your tone-line work, you can do some spotting and retouching work prior to each exposure stage. This not only helps to reduce the effects of the clear pinpricks you nearly always get with lith film, but also enables you to 'tidy up' messy detail which has only just survived the conversion from continuous tone into a line image. Without retouching, every clear spot or area will print dark, either in the subsequent contact print for a positive or negative image, or in later printing of the combinination of the two for your tone-line—failing to do this may spoil an otherwise perfect print.

Tim Stephens

Aborigine *Having made your tone-line sandwich, you can print from a positive or negative on colour paper to achieve any combination. This effect could be produced by giving a two-stage exposure—an overall exposure to give some colour in the lines, then the line exposure itself.* **Memorial** *This combines a tone-line image with a weak tone image to give an almost surrealistic effect*

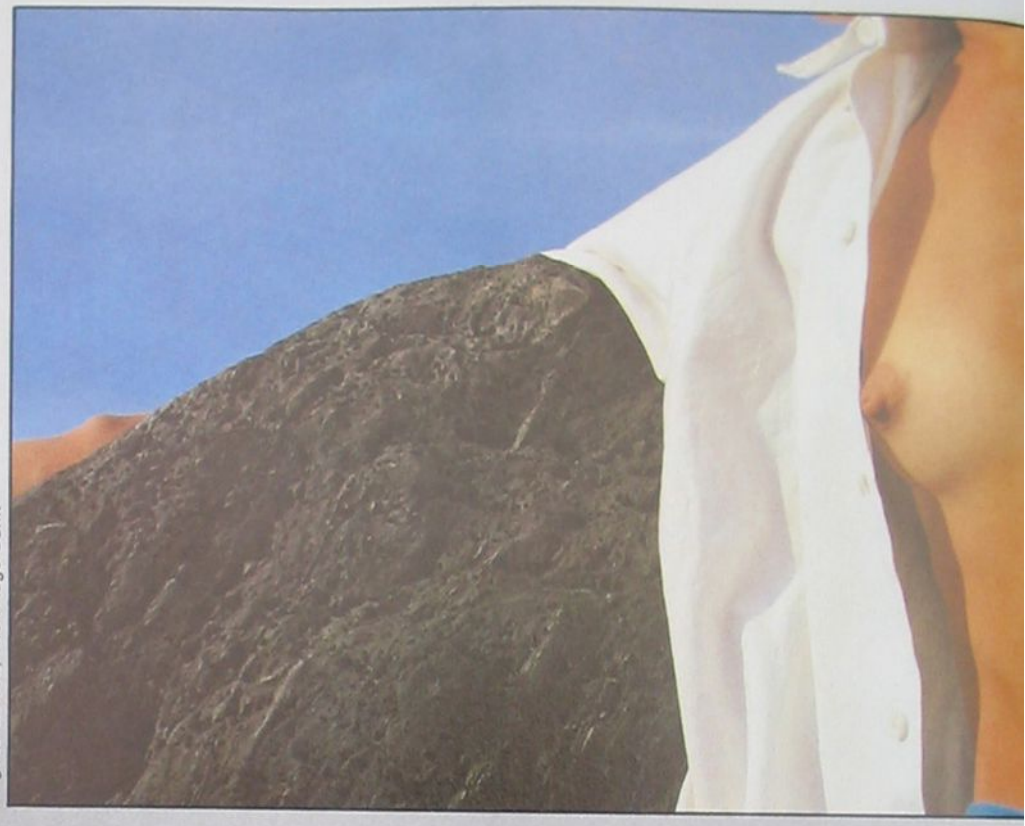
Creative approach

Abstract nudes

The nude form, despite its familiar shape and structure holds a wealth of new and unusual material for the photographer with an eye for the abstract

The nude has always been a popular subject for artists, and particularly for photographers. But photography also makes it possible to create new images, totally unlike those traditionally associated with the nude. In abstract nude photography the model's personality and expression are obscured and the photographer's own ideas take shape. It is a field in which the photographer's eye and ability are far more important than the model's looks or studio experience.

The human body is particularly suitable for an abstract approach as it possesses such strong qualities of shape, form and texture which can be exploited as subjects in themselves. It is also extremely variable and flexible, and can easily evoke an emotional response.



Hughes Colson/The Image Bank

White shirt *You can create a study in colour, shape and texture by combining a section of a nude body with sections of other, contrasting objects*

Neck and shoulder *A close-up of a selected part of the body can result in a pleasing picture based on line and contour*

Jean-Paul Debattice

even when depersonalized. In fact, an abstract nude can often be highly erotic, far more so than nude photographs which use an obvious, direct approach. And abstract photography makes fewer demands on the physical perfection of the model, which makes the choice of model very much easier.

Tight framing is a very simple way of shooting abstract nudes. Small sections of the body can be isolated and shown completely out of context, creating an emphasis on shape and form which can be an abstraction in quite a literal sense, since these shapes need not be recognizable as a body at all. With this type of abstract nude the flexibility and manoeuvrability of the body becomes a great advantage. Even the flexing of a muscle alters shape and form in the image, and so you can produce many different pictures in one session, provided that you have a cooperative model. A telephoto lens is an advantage in these circumstances, as you can frame small areas of the body without having to move the camera too close to the model. You will find that closely framed pictures, such as these, tend to emphasize the quality and texture of the model's skin.

Strong sidelighting can be used to give even more emphasis to texture, when it is of particular interest in the picture. However, the slightest blemish will be exaggerated and you may have to take steps to avoid this problem if it creates an undesirable effect. An application of foundation cream finished with a matt powder covers most small spots or flaws quite well. The most unsightly marks are usually the effects of tight clothing, such as waistbands, and it is worth allowing plenty of time for these to disappear before you start shooting, as they will be recorded clearly on film even when only just discernible to the eye.

Many photographers of the nude tend to concentrate on the most obviously

Michael Busselle

photogenic and sexually attractive parts of the body, particularly with the female body, but you will find that there is a wealth of equally pictorial potential in less obvious parts. The angles and curves made by both knees and elbows can create strong abstract images, and extreme close-ups of areas such as ears and toes can provide endless possibilities. Try experimenting with the juxtaposition of limbs and other parts of the body, arms folded round knees, for instance, or hands clasped at the back of the neck.

Since you are producing an abstract image there is no reason why you should be restricted by the limitations of familiar or even logical positions and juxtapositions. If, therefore, you have a particularly athletic or pliable model, there is a wide variety of interesting shapes and contours that you can create. You can also experiment with camera viewpoint and model position to obtain further variety. Try positioning your model on a table and shooting from a very low viewpoint. Alternatively, photograph your model from an unusually high angle. If you have two suitable

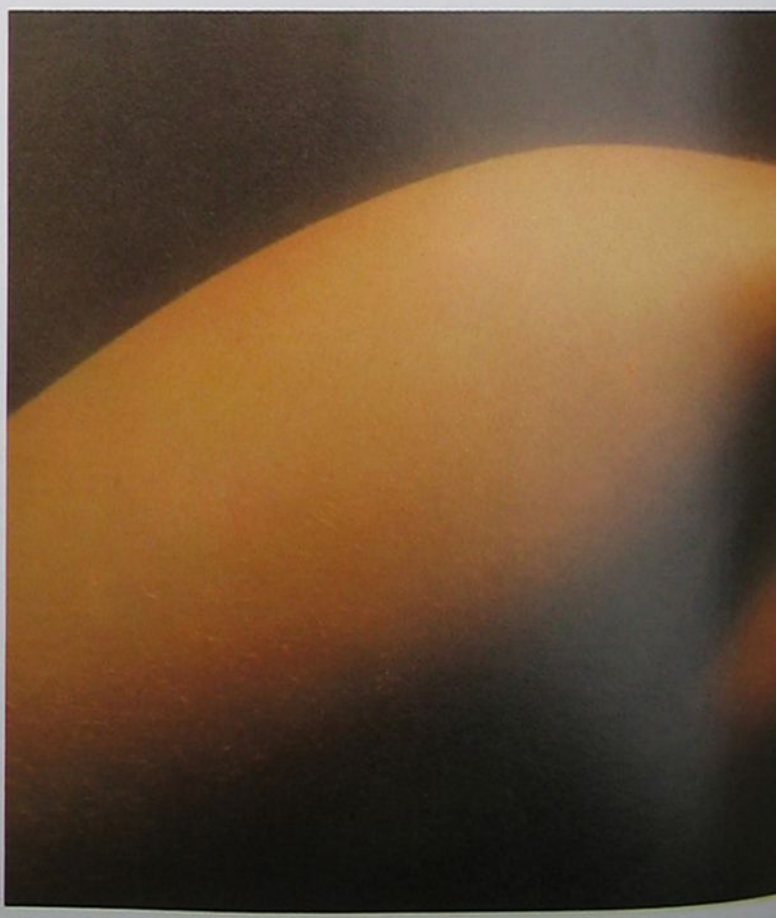
Don Hunstein/Colorific

Footwork *Do not overlook the less obvious parts of the body which can provide dramatic abstract images*

Male nude *The pronounced form of the male body's muscle structure can be enhanced with black and white film*

Shape and form *You can concentrate on pure shape and form by subtle lighting, controlling highlight and shadow areas*

Headless nude *Bill Brandt reduces skin texture by using high contrast techniques so that shape dominates the image*



Katherine Vibert

Bill Brandt/Marlborough Fine Art

John Garrett

models there are a great many additional possibilities that can be produced by juxtaposing and intertwining two bodies and sets of limbs instead of just one, without erotic overtones.

A female model is undoubtedly the most popular choice for nude photography but there are many largely unexplored possibilities for photographing the male nude. With close-up images, for example, the more pronounced and visible muscle structure can give you stronger contours and more vigorous and dramatic angles, and the texture of male skin can be more effective when emphasized. There is a tendency to flatter and soften the image of a female nude whereas this restriction is seldom felt appropriate with a male body, and poses which may look ugly and awkward with a woman's body can look quite the opposite with a male model.

Lighting is an important factor in abstract nude photography, since you can use it not only to reveal and create elements of form and texture, but also to produce abstraction. In normal circumstances lighting is designed to create a brightness range so that detail is visible in both the lightest and darkest areas of the image, but by careful lighting you can alter the tonal range of the subject, and lose some elements of an image while emphasizing others. Obviously this is more easily achieved when using studio lighting, but you can control daylight by your choice of camera viewpoint and model position and also by the use of reflectors. With studio lighting you can, for instance, create silhouette effects by rim lighting in which only the outline of the body is visible, or you can create extremely high contrast so that either, or both, the lighter or darker tones of the subject are recorded without detail. You can also create a very soft high key effect where the body almost merges with the background.

In addition, lighting is a crucial factor in creating and emphasizing such key elements as form and texture in abstract nude photography. As a general rule, the most effective light for revealing the form of the body without undue emphasis on the skin texture is a large soft source from one side of the model. In the studio you can produce this effect with a large diffuser, such as a tracing paper screen, or by bouncing the light from a white reflector. In daylight, clouds or open shade create a soft but directional light which will achieve the same effect. Try to avoid hard light such as direct sunlight when you want a smooth, flattering skin quality, particularly with pale skins. A harder light can be effective either with a deeply tanned or black skin, or where skin texture is an important element of the picture. In this case, you can emphasize the texture yet further by applying olive oil or suntan lotion. The tactile quality of skin can contribute considerably to the erotic aspect of an image. You can heighten this aspect further by juxtaposing the skin against other textures such as sand, water or fur.

When shooting abstract nudes on colour film, pay particular attention to the colour quality of the light, since skin tones can produce an unpleasant effect if they have even a slight blue cast—a cloudy day, or open shade, often produces this effect. On the other hand, a degree of warmth in the colour quality is quite attractive and many photographers consider a Wratten 81A or 81B filter a permanent fixture when shooting nude pictures. If your model has rather blotchy skin, an orange filter will reduce the effect, though it will produce a strong colour cast. The same result can be achieved by using daylight film in tungsten lighting.

Exposure has an important effect on skin quality. Slight overexposure may produce a picture where the colour or tone of the skin is quite pale and the texture is minimized, creating a flattering effect such as is seen in the soft, romantic images made by photographers like David Hamilton. A degree of underexposure will make the skin tone and colour much stronger, emphasizing texture. This technique is used for producing the rich tones of suntanned nudes on tropical beaches, as frequently seen on calendars, for instance.

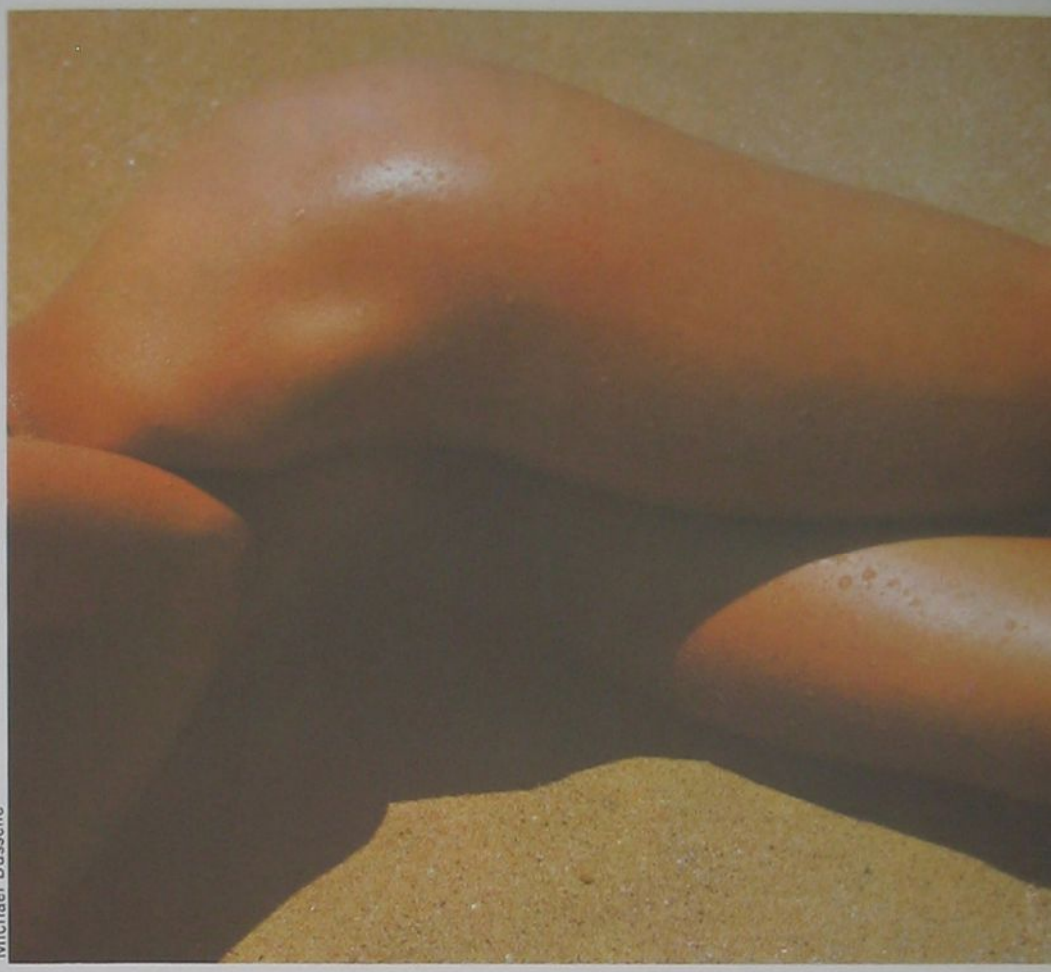
Taking an exposure reading can be less straightforward than it might seem at first, since the skin tone is likely to

fill the frame, and the colour of the model's skin will have a considerable effect on the reading. A pale skin needs one or two stops more than may be indicated when a reading is taken, for instance, to give an accurate exposure, and a tanned or black skin may well need one or two stops less.

In many pictures of abstract nudes there is little else but the body included in the frame, but there are occasions when it is possible to add both interest and impact to a picture by using other elements such as a background, a prop or clothing, to complement or emphasize the body. The comparison between a nude and a landscape is both well known and justified, and a photograph of a nude in a landscape setting, or with elements of landscape, such as rocks or trees for instance, can often be extremely effective because of their affinity.

In the studio, or indoors, a piece of fabric, a chair or some element of interest in the background can create the same sort of effect as well as helping to create a mood. A well chosen location such as an interesting room or a dramatic landscape can actually help to suggest the approach you might adopt towards posing and lighting your model and can often give rise to a variety of quite different ideas and images.

In addition to the ways in which the image can be framed, lit and composed there are many other ways in which a degree of abstraction can be created by photographic techniques. Perhaps the most obvious is to use the characteristics of different focal length lenses to create interesting or unusual perspectives. The dramatic nudes taken by Bill Brandt with an ultra wide angle lens are good examples of perspective effect actually creating pictures. Telephoto lenses can also be used to create unfamiliar juxtapositions of limbs and body and, in outside locations such as a landscape setting, can produce compressed perspective effects, as well as helping to isolate a small area of scene from a distant viewpoint. A fisheye, too, can be used for abstract distortions.



Michael Busselle

On the beach *Skin quality can be accentuated by contrasting it with a background of a different texture*

Edouard Ville/fotogram

Rocky landscape *The unusual position of this nude in a landscape setting adds greatly to the visual effect*

Black and white *The subtle qualities of skin texture are best revealed by using soft, diffused lighting*

You can also use prisms and mirrors to create a variety of multiple effects, and reflections in flexible plastic mirrors, if carefully controlled, can create quite bizarre distortions. Double exposures can be an effective way of making abstract images, both in the studio and outdoors, either by combining several images of the body against a dark background, or by combining an image of the body with another quite different element such as a landscape. Infrared film can also create quite strange and abstract images, especially outdoors, and is available in both colour and black and white.

There are many other effects which you can employ in the darkroom, such as a simple slide sandwich where a picture of a nude against a plain background could be combined with a transparency of, say, a seascape, or a textured surface. Montage printing is another darkroom technique in which a nude can be effectively combined with other images to create an abstract effect.

Developers in practice

The large range of developing agents and additives can be mixed in a huge variety of ways. This allows developers with particular characteristics to be made for different types of film and paper

There are literally hundreds of developer formulae for black and white films and papers alone, and many more for colour materials. Among monochrome developers, the most popular are those embodying metol and hydroquinone — called MQ — or phenidone and hydroquinone —PQ developers. This popularity is well deserved, as by varying the proportions of the two developing agents and the amount of alkali, developers of different contrasts are obtainable.

MQ and PQ developers have several desirable properties. They do not stain materials or the fingers, they do not produce excessive development fog, their storage lives are measured in months and a print developer in a dish will keep on working for about 24 hours before turning brown and becoming inactive.

A typical MQ developer for large format films may contain 2.5 grams per litre of both metol and hydroquinone, 50 grams of anhydrous sodium sulphite as the preservative and 20 grams per litre of a mild alkali such as sodium metaborate. Only a small amount of restrainer is needed for a film developer and 0.5 grams per litre is usual. Such a developer will develop an average film to satisfactory contrast in less than five minutes. Such a developer is classed as soft working and would not be very satisfactory for printing papers as it would call for long development times to produce good blacks.

Paper developers

An MQ or PQ developer for printing papers may contain a large ratio of metol or phenidone to hydroquinone, 1 to 4 in the case of an MQ formula, and the alkali will be sodium carbonate in quantities up to 20 grams per litre. To ensure low fog levels, giving clean whites, the developers include about 1 gram per litre of potassium bromide or, in the case of developers containing phenidone, benzotriazole, as an antifog agent. A print will be developed to its full contrast in one minute or less at 20°C.

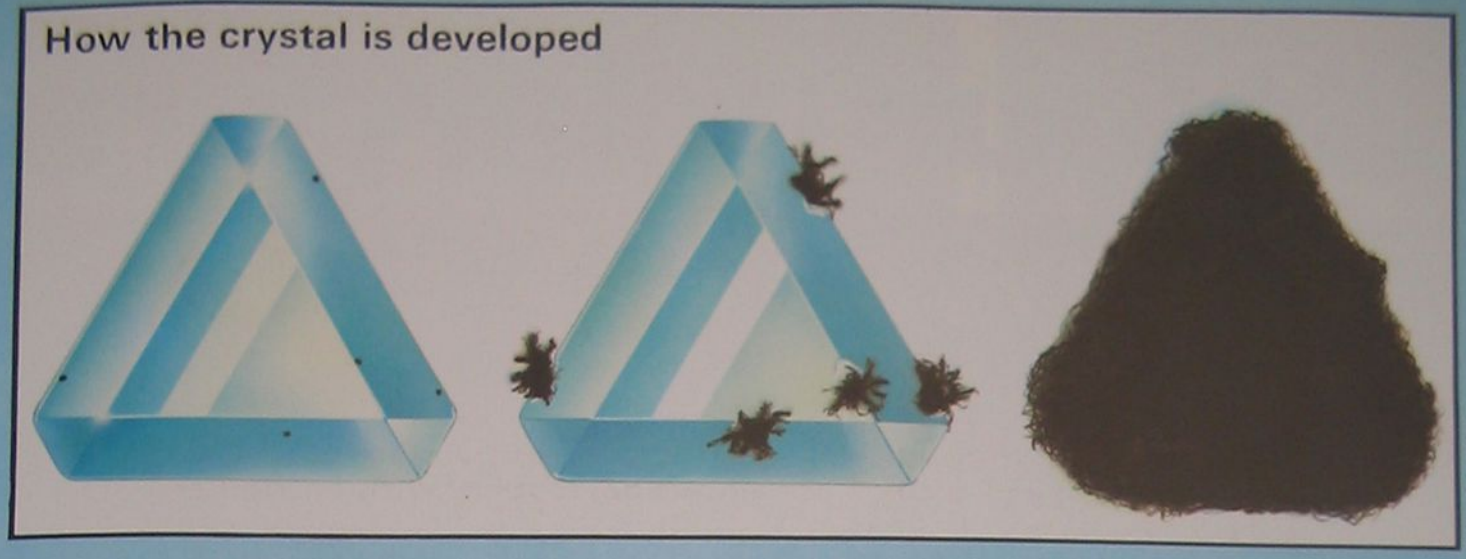
An MQ developer designed to give higher contrast than normal may have a ratio of metol to hydroquinone of 1 to 9, 30 grams per litre of sodium carbonate and 5 grams of potassium bromide. A developer like this is satisfactory for copying line diagrams on high contrast films and it can also be used for printing papers when higher than normal contrast is wanted.

High contrast formulae

For the highest degree of contrast on line film, the MQ combination is abandoned in favour of hydroquinone on its own, using sodium hydroxide as the alkali. Such a developer can be made up as a single solution but, as its storage life in a fully sealed bottle is only two months, it is usual to make it as two stock solutions, one containing the hydroquinone and sulphite and the other the alkali and restrainer. The two solutions are mixed in equal parts just before use.

A special high contrast formulation of a caustic hydroquinone developer is designed for lith films. With a lith developer the by-products of the reduction process are themselves vigorous reducing agents so that in exposed areas of the film, silver halide crystals near to those which are being developed are also reduced

Developer range *There is a large range of developers available in both powder and liquid form. The developers shown here include those for lith and normal films, black and white papers, and a complete set of colour chemicals*



Developer at work *The developer acts first on sensitivity specks in the crystal to form black silver*

to silver. This infectious development increases the ultimate density of exposed areas producing extreme contrast. Excessive development causes the effect to spread outside the exposed areas and fine lines can become clogged.

Low energy developers

At the other end of the activity scale, low energy developers are useful for giving minimum granularity —fine grain—which is especially important with small formats such as 35 mm. One of the best known developers of this kind is Kodak formula D-76, which is the same as Ilford ID-11, and is an MQ combination using borax (disodium tetraborate) as the alkali. It gives moderately fine grain but without reducing the effective speed of the film, which is a fault of many fine grain formulae. The fineness of grain results in part from the low energy, requiring development times as long as 12 to 15 minutes, and also from the high concentration of sulphite—100 grams per litre—which produces a slight solvent effect. This means that the halide crystals are made slightly smaller as they are developed, which keeps the overall graininess down.

Perhaps the simplest developer formula for small format films is Kodak D-23. Similar in properties to D-76 and ID-11, it contains only metol, sulphite and water. It is ideal for high contrast subjects as even long development times cannot make it give an unprintably high contrast range.

Acutance

As films have improved in recent years, especially with regard to granularity, the need for the innumerable fine grain formulae which were once current has passed. The goal now is the best possible sharpness in negatives and there has been a proliferation of high definition formulae, both secret proprietary and published types. A developer like D-76 can be made to give improved sharpness by using it more dilute than usual, say diluted 1 to 1 or even 1 to 3 with water. Such dilution lowers the concentration of the sulphite and granularity is increased slightly but this is a small price to pay for the increased edge sharpness.

A feature of all high sharpness developers is that they embody energetic developing agents and are used dilute. The improved sharpness relies on the restraining effects of soluble bromides released during development which increases the contrast at the boundaries between high and low densities, giving better visual sharpness.

One shot developers

Highly concentrated developers can be made up by using paraminophenol as the developing agent and a caustic alkali as the accelerator. At one time quite a range of these developers was available, including Azol, Certinal and Rodinal, but only the last of these is still generally available. Such developers are diluted 1 to 20 or more for use and give excellent sharpness and freedom from development fog. Diluted even further a paraminophenol developer gives improved sharpness.

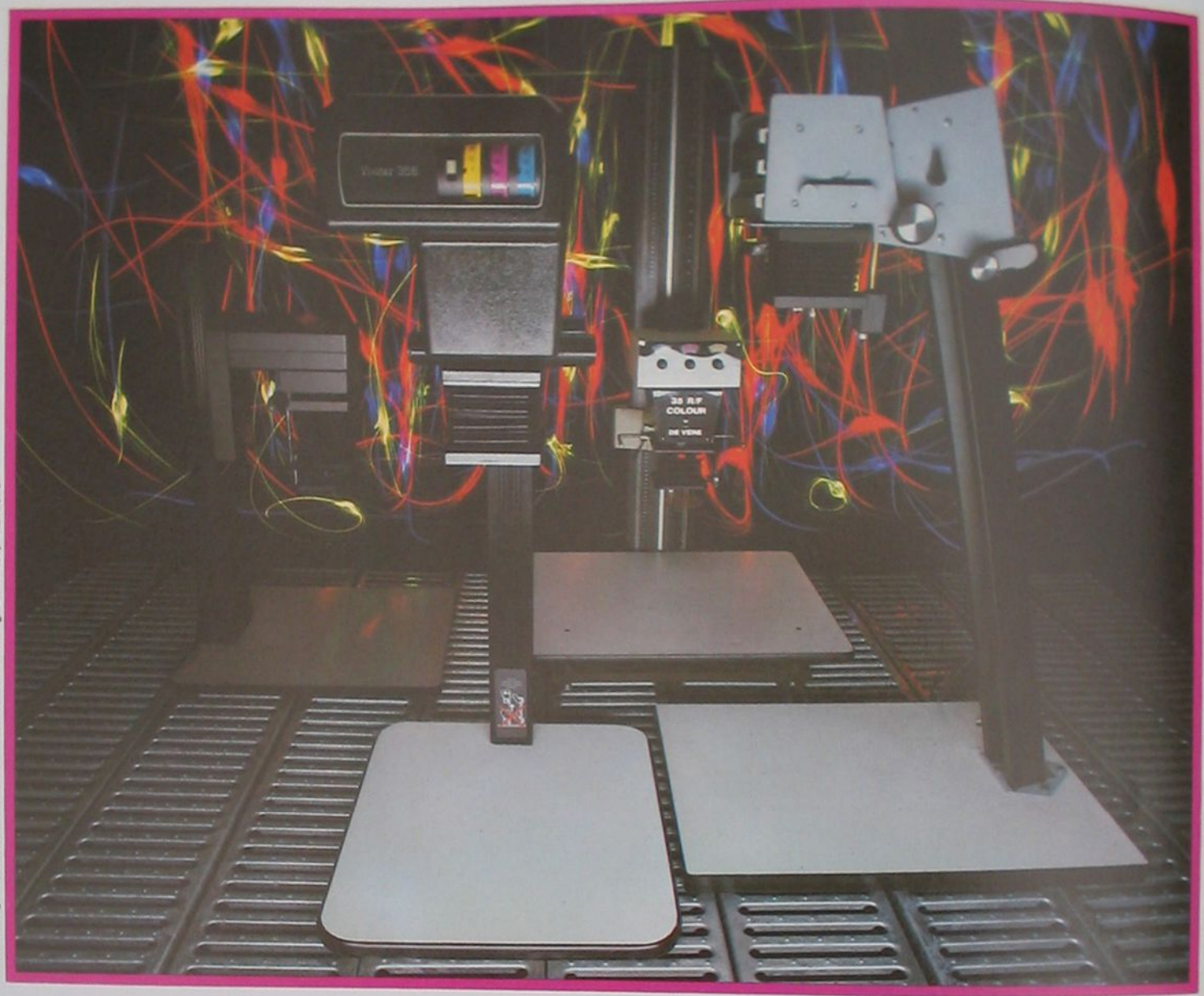
Colour developers

All colour developers, which are essential in the production of coloured images in negatives, slides and prints, make use of the developing agent paraphenylenediamine (PPD) or one of its several derivatives. PPD itself figured in many of the old extra fine grain formulae for black and white films but it is no longer used for the purpose partly because it involves considerable loss of film speed. In colour development the reaction by-products, which form as silver is developed, combine with colour couplers in the emulsion layers of the material to form dyestuffs—yellow, magenta and cyan. The silver has to be removed by bleaching and fixing to leave only the dye images which constitute the final images.

This *chromogenic* development is also used for toning black and white prints to any desired colour. The silver is converted back to a halide and then redeveloped in a colour developer which incorporates a suitable colour coupler.

Robinson/Brown

Colour enlargers



Dave King/Equipment courtesy of Vivitar, Pelling & Cross/De Vere

Buying a colour enlarger or head can greatly expand the scope of your darkroom work. But the differences between the various types are not always obvious, and it is worth looking at some features in detail

If you want to make colour prints regularly, you must have some means of controlling the colour of the light passing through the negative. This allows you to not only compensate for differences between types of film or paper, but also to adjust the colour balance of a print. You can either convert your black and white enlarger for this purpose, or you can buy a special colour enlarger.

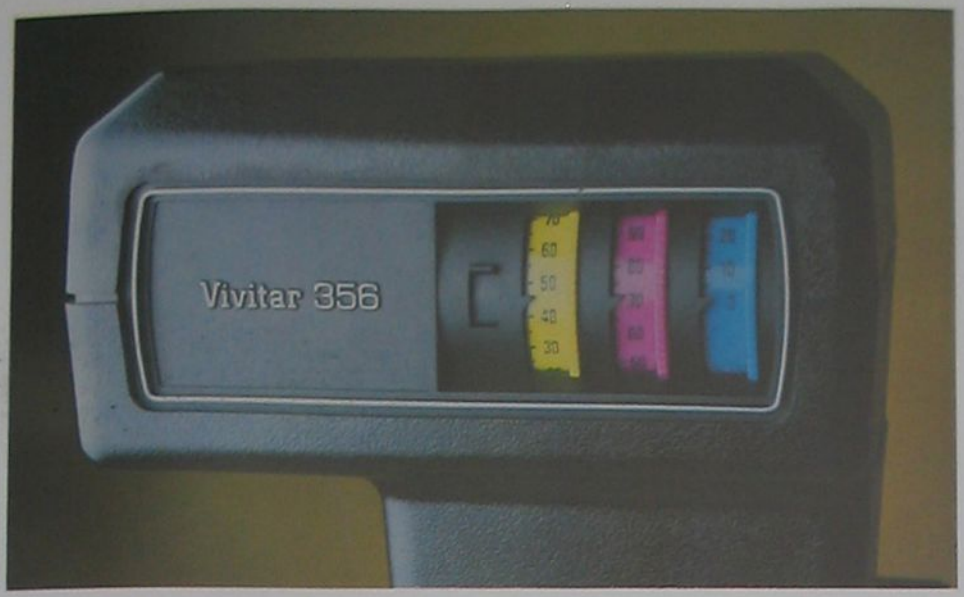
All but the simplest or oldest black and white enlargers have a filter drawer, which can take different combinations of coloured filters. This is the simplest and cheapest way of controlling the colour of light. If the lamp house or *head* of the enlarger is interchangeable, you can convert a black and white enlarger by fitting a *colour head*, which has a built in facility for colour filtration. Alternatively, you can buy a complete colour enlarger with a colour head already fitted.

Using filters

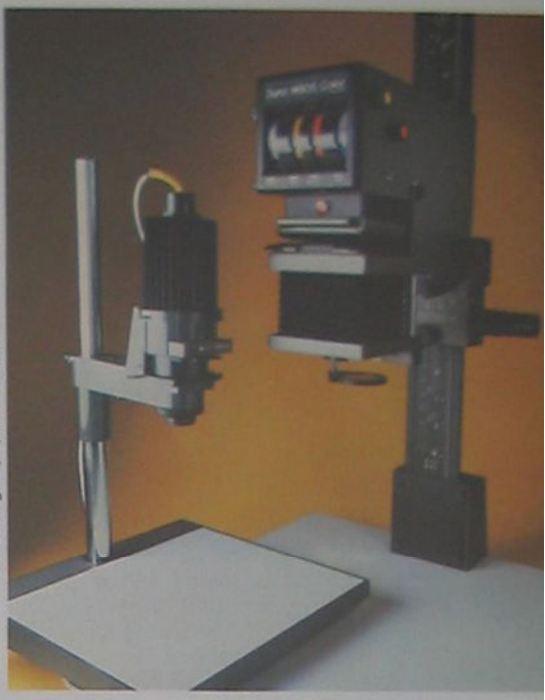
The filter drawers of black and white enlargers usually accept filters 75 mm or 100 mm square. These can be bought as coloured sheets in sets comprising the three subtractive primary colours—yellow, magenta and cyan. The sets include filters of different strengths, and in printing a *filter pack* is made up to produce a given colour correction. The disadvantage of this method is that you cannot have a continuous variation of strength and are limited to the steps available from your set of filters.

On most enlargers, the filter drawer fits between the lamp house and the film carrier. Where the design of the enlarger does not permit this, you can still introduce filtration by fitting a filter holder below the enlarging lens. This is not the ideal situation, though, because filters in this position can affect the sharpness of the projected image. Another possibility is to put filters on top of the condenser lens—though this is only feasible if the lamp house is easily removable to allow filter changes.

A touch of colour *Enlargers (above) vary enormously in their design, versatility and ease of use*



Filter details *Most colour heads use dials to control the amount of cyan, yellow and magenta light transmitted*



Dave King/Equipment courtesy of Vivitar, Paterson & Durst

Head and drawer *The cheaper model on the left has a filter drawer, giving a simpler and more compact design*

The major advantages of this system are cheapness and simplicity—filters cost no more than a couple of rolls of film and you do not need to worry about converting the enlarger.

Colour heads

Some colour heads, known as filter bank heads, have a set of built in filters, mounted already to slide into position. Only magenta and yellow are incorporated usually, because they are used most frequently when printing negatives. On those occasions when a cyan filter is needed, it can be inserted in a separate filter drawer, as can extra filters needed for printing certain negative films. If you usually print only negatives, rather than transparencies, which require cyan filtration, this type of head may be adequate. The Paterson Color 35 enlarger has this type of head.

Another type, called variable filtration heads, do not use separate filter sheets, but have three very pure, deep coloured filters which are gradually introduced into the light path to change the intensity of a given colour. This is controlled by means of dials marked in units, one dial for each colour. A diffusing or mixing chamber incorporated in the head mixes the different colours of the light thoroughly and avoids patchy illumination.

Most heads of this type—also known as dial-in heads—use *dichroic* glass filters, which do not fade and give very pure colours. Some cheaper models use dyed glass or plastic—the Durst C35, for example, has only two plastic filters, yellow and magenta.

A third method of controlling the colour of light is to have three coloured light sources in the colour head—red, green and blue. These primaries give the required colour when mixed in the right proportions. This system is convenient because brightness is electronically controlled, and remains constant irrespective of the colours used in the combination. This means that you do not need to make any exposure compensations when using this system. The Philips Tri-One enlarger is an example of this type of head.

Most colour heads incorporate built in ultraviolet and heat resistant filters, but some of the cheaper ones do not. If they are not supplied with the enlarger, they can be bought separately and inserted in the filter drawer.

Converting for colour

If you already own a good quality black and white enlarger, you can convert it for colour use by exchanging the existing head for a colour one. A great choice is available, but which you buy depends to a great extent on which heads fit the black and white model you already own.

'Dedicated' colour heads or conversion kits usually fit only one model—the C35 conversion for the Durst B35 black and white enlarger, and the colour module for the Leitz Focomat V are examples. Multi-mode heads, on the other hand, usually fit the range of only one maker, but several models in that range. One of the Durst colour heads fits all the 6 × 6 cm models, another all the 6 × 9 cm ones, and a third all the 5 × 4 inch ones. Some types fit the whole range by a given make—the Meochrom head for the Czechoslovakian Meopta enlargers, for example.

There are also some independent colour heads available which fit a number of different makes. The best known of these is the German Wallner colour

Dave King/Equipment courtesy of Durst

Changing heads *With many black and white enlargers it is possible to remove the lamp housing (far left) and replace it with a colour head. This contains both the lamp and the colour filter system*

head, which can be bought with adapters for Leitz, Dunco, IFF and a number of other makes, including some enlargers meant for black and white work only.

If you do not already own a black and white enlarger, or only possess a cheap one which cannot be adapted for colour printing, you might want to buy a colour enlarger. These have built in colour heads—the cheaper ones usually have a fixed head, while some of the more expensive ones have interchangeable heads. Whether you buy an enlarger or a colour head, the same considerations apply with regard to light sources and colour controls.

Light sources

The type of lamp used in an enlarger or colour head determines the brightness of the projected image and the filtration required. Simple filter drawer enlargers may use ordinary mains voltage, 75 to 150 watt enlarger bulbs—the Durst C35, for example, uses a 75 watt bulb with a built in silvered reflector.

However, since small voltage fluctuations can affect the colour of the light from the bulb, this is not the ideal source for colour work. A better light source is a low voltage lamp running from a transformer which gives a stabilized output. Tungsten halogen lamps, which often have built in reflectors, have a high light output and run on low voltages, usually 12 or 24 volts, so they must be used with a transformer. Typical power outputs are 50, 75 or 100 watts. Bulb life is anything from 50 to several hundred hours, maybe longer if the lamp has a fan-cooled head.

Halogen lamps need more filtration than ordinary tungsten bulbs because the colour temperature is higher, but they are much brighter. Maximum output is obtained if you overrun the lamp, but this reduces lamp life. Underrunning the lamp produces a warmer, dimmer light, and lengthens lamp life. Colour negatives can fade with repeated exposure to bright light, and underrunning reduces this, but unfortunately you can rarely tell whether a lamp will be overrun or underrun when choosing enlargers.

Dave King/Equipment courtesy De Vere

Legible head *To avoid mistakes it is important that the scales on the filter dials are very easy to read*

It is important that the lamp house of an enlarger or colour head should be properly cooled if you are to obtain the best service from your bulbs. Overheating shortens lamp life and changes colour temperature, so you may need to make adjustments when you change a bulb if your head is not cooled properly.

Diffused and direct light

The majority of enlargers and colour heads use a diffuser box to mix the coloured light. Diffuser boxes take various forms—they may be shaped chambers, frosted mirrors, or sheets of opal perspex. The more thoroughly the light is mixed, the more light is lost—cheap models may give a slight colour shift from the centre ot the edges, to avoid a dim image, while the more expensive models give the highest light output compatible with proper mixing.

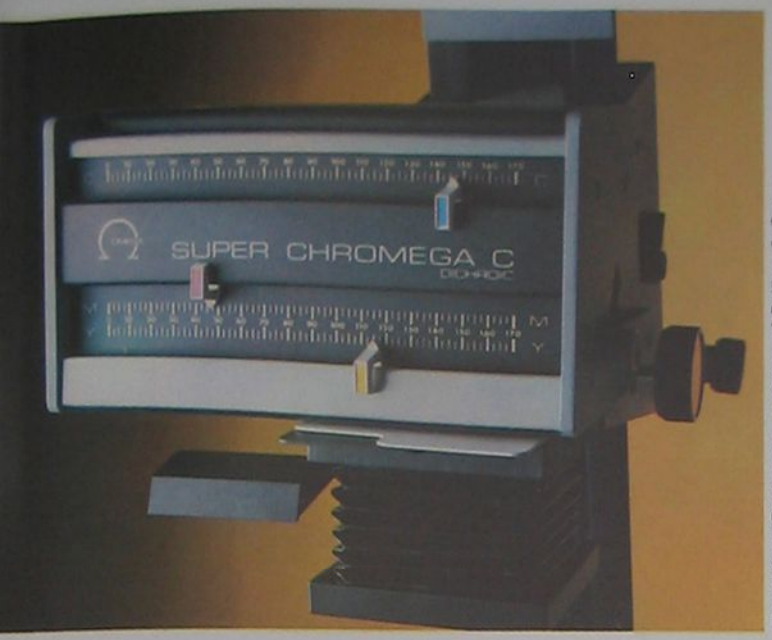
Diffused light is the most common in colour printing, because it gives low contrast and does not emphasize grain and marks on the negative. However, some colour heads, such as the Philips Tri-One, use a condenser lens, which gives the direct light more often used in black and white work. Condensers mix the light just as well as diffusers, but are much brighter. The resulting prints have saturated colours and good contrast, but every blemish on the negative is shown up, so processing and negative storage must be perfect. Some enlargers have a diffuser plus optional condenser illumination—this makes them very suitable for both colour and monochrome.

Colour controls

Most enlargers and heads have three dials for controlling the colour settings, usually on the head itself. On a small enlarger, this can cause vibration if you adjust the controls just before making an exposure. Other models have the con-

Dave King

Remote control *Some enlargers feature separate control panels which are very convenient in operation*



Dave King/Equipment courtesy of Pelling & Cross

Colour control
A few enlargers feature sliding scales which are easy to check at a glance
Colour source
Some enlargers use three lamps rather than one lamp and three filters

trols at bench height, while one, the Philips, has an electronic benchtop console. Both these arrangements avoid vibration of the enlarger head, and make it easier to use the controls when it is at maximum column height.

Cheap enlargers and heads may have non-linear filter scales, which means that the distance between 0 and 5 on the control may be the same as between 75 and 100. This makes accurate settings difficult at high filtration values. More sophisticated models have a linear scale, where the distance between all values is the same. These are accurate to within five units, some of them even to within one. For occasional negative printing, or working from transparencies, accuracy within five to 10 units is acceptable, but for fine control in negative printing you need to be accurate within one or two units.

Another useful feature in an enlarger or colour head is illuminated scales, with large clear markings which are easy to read in the dark. A white light control is also convenient—this removes all filtration instantly, allowing you to focus in bright light, and then replace the filtration at the preset values, ready for the exposure.

Many enlargers and heads have the controls combined with a timer—the Philips colour console is of this type. Though designs vary, they all work on the principle that having determined exposure and filtration, you set filtration and timing on the colour controls. The unit then gives consistent exposure times at the set filtration.

Some more sophisticated units also have built in colour analyzers, which determine the colour balance of a negative. From the data they provide, you can work out the correct filtration for a given negative. Some of these even have an electronic memory which stores filter and exposure data—the Vivitar Darkroom Computer is an example, intended for use with Vivitar colour enlargers. Although not part of the colour head, these can be useful if you plan to do a great deal of colour printing. However, make sure that the colour analyzer/timer you buy suits your enlarger—not all makes use the same colour filter units. For example, 100 Kodak units are equal to 70 Agfa units, and to 60 Durst units. Most independent units use either the Durst or the Kodak scale—the scales are not compatible.

What to buy

What you buy depends on how much printing you want to do. If you want to make prints from transparencies, or only print from negatives occasionally, then it may not be worth your while buying a head or a complete enlarger. A set of filters that fit into your colour drawer should be sufficient for your purposes as reversal printing requires comparatively few filter changes.

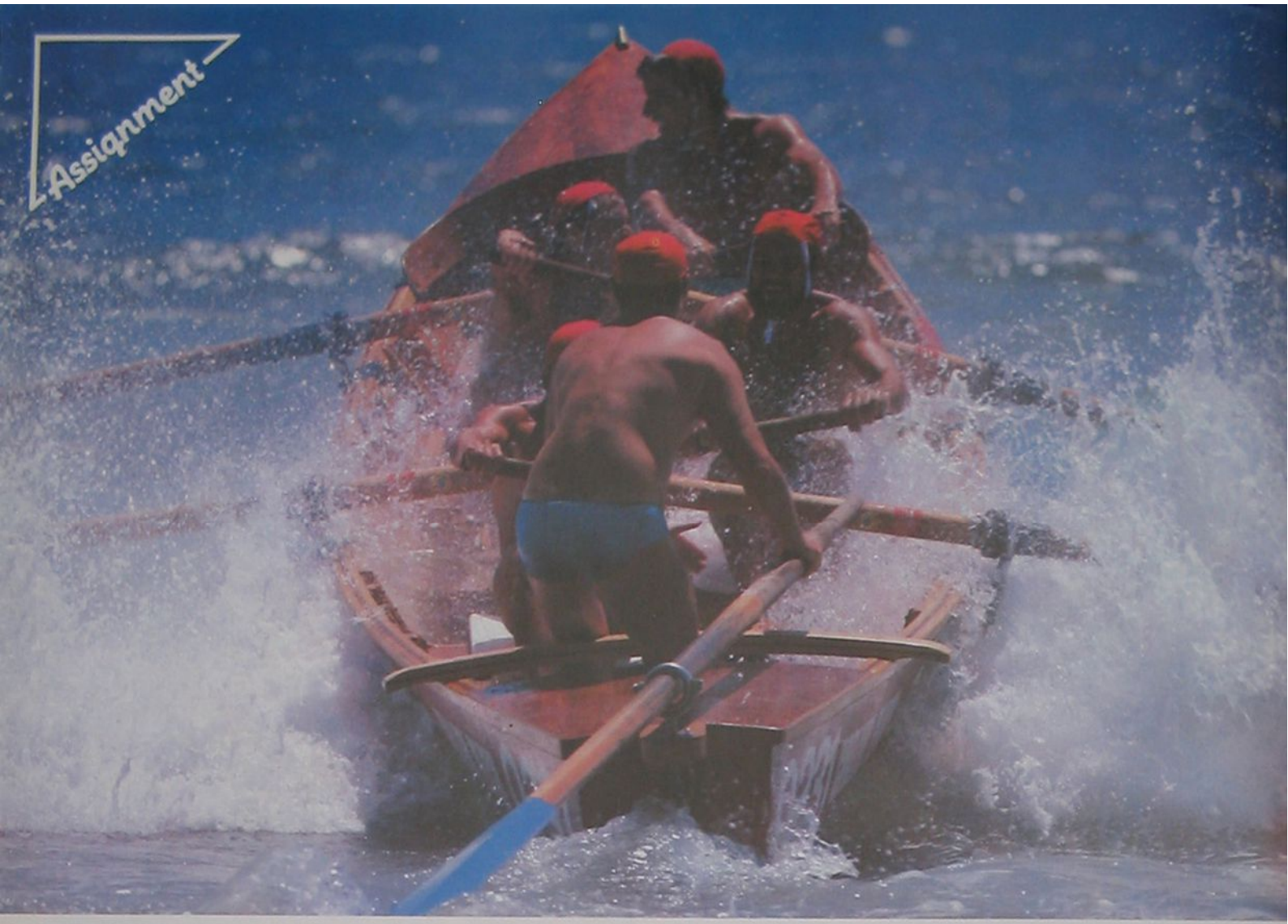
If you want to do serious colour work, you should buy a good quality colour enlarger, or, if you already have a good convertible black and white enlarger, a compatible colour head. It does not make any difference whether you convert a black and white enlarger or use a colour one—print quality is equally good, provided you use dichroic filters. Make sure, too, that your enlarger or head has a diffuser as opposed to a condenser, unless you are prepared to work to the standards demanded by condenser illumination in colour printing. If you want to use your enlarger for black and white work, optional condenser illumination is a useful feature. However, all colour enlargers, with or without condensers, can be used for black and white printing.

Many of the cheaper colour heads and enlargers have plastic housings—these tend to attract dust, however, and retain heat. Metal housings are preferable, and are less prone to static electricity than plastic ones.

Lighting, too, is an important consideration. Low voltage lighting run off a transformer is a very useful feature in colour work. If you buy an enlarger with this type of light source, one with a built in transformer saves space in the darkroom. Another useful feature on enlargers is a column marked in centimetres, or in magnification values for the lens in use—this allows easy calculations of any changes in exposure you may need to make when you adjust the degree of enlargement. If there are no markings on the column, details of the necessary exposure adjustments should be in the instruction book.

If you decide to buy an enlarger, a fast enlarging lens—say *f*/2.8—is an advantage, as exposures in colour work can be quite long. The lens should be fully colour corrected. Other useful points to look out for are a reversible column and a 90° head tilt, which allow you to project the image on the floor or wall for very big enlargements. When you buy your enlarger, remember that a model sold with all negative carriers and accessories complete may mean a considerable saving.

Assignment



Surf carnival

For many photographers, exciting action subjects and good strong light tend to be things which happen at different times—rarely together. Not so in Australia where Surf Carnivals frequently show this combination

'It's so good to be able to spend a good part of the European winter in a place where you can quite happily shoot Kodachrome at 1/500 or 1/1000 second. There's never any problem with camera shake in Australia!' Nigel Snowdon has an almost annoying habit of appearing in the office with an enviable tan and with stories of fascinating assignments in exotic locations. This time it was his annual retreat to his former home, Australia, to cover the Grand Prix as well as 'a little tennis and golf' and to generally dry out from a very wet motor racing season.

Between the Australian Grand Prix and various other events on the antipodean sporting calendar, Nigel looked for some more relaxing subjects that could be combined with something akin to a vacation. As he explained, 'I rarely have holidays like most people—wherever I am, I always look for something to photograph—even on the beach. In the two months I spent in Australia, there were only two days when I wasn't taking pictures—and one of them was Christmas.'

During his excursions to the beaches, one in New South Wales and one in Queensland, Nigel turned his cameras on surf carnivals. These are regular features of the Australian summer and mainly consist of races out to a buoy, battling against the strong surf, both going out and coming back. This is done either by teams in boats or by individuals on surfboards. The day is also filled with lifesaving competitions, parades and other events that are taken very seriously by the competing teams.

If a photographer can manage to keep valuable equipment away from the sand and spray, a surf carnival offers plenty to photograph. Although such an event is slightly different from most of Nigel's

Nigel Snowdon

work, he found that it was best approached from basically the same angle as any sporting event. 'I tried a few wide angle shots to show the whole scene which is important if you are covering a relatively unfamiliar subject. I found the 16 mm was particularly good for this—it gets everything in the frame but also produces an interesting effect. My 180 mm lens was also useful for picking out characteristic details and isolating them from the background.'

However, since the most exciting action takes place in the surf, Nigel decided that a long focus lens was essential. His bitingly sharp 400 mm ED Nikkor was ideal for this—sometimes even used with a Nikon X2 converter. The bright midday sun allowed him to use Kodachrome 64 with a shutter speed of 1/500 second and still be able to stop

Into the surf *To fill the frame with action, a telephoto lens is essential. Here, Nigel used a 400 mm Nikkor—the high standard of the lens can be seen in the pin sharp definition. He found that a shot of the team setting off into the waves worked best—their return to the beach was so rapid that it was hard to keep them in focus.* **Fisheye view** *Nigel's 16 mm full frame fisheye lens was ideal for setting the scene—its characteristic distortion created a more unusual image.* **Surf team** *The 180 mm telephoto used for this shot cropped out all unwanted details and threw the background out of focus.* **Sign** *One thing that signifies Nigel's coverage of almost any event is his keen eye for associated details, like this sign.* **Scoreboard** *Even for shaded subjects, the bright sun allowed shots taken at only 1/500 sec*

down to around *f*/8 or *f*/11. The fast shutter speed froze the spray in mid air and prevented any camera shake with the longer lenses. Even so, Nigel had to use a monopod to help support the 400 mm telephoto, especially when the shutter was pressed.

A surf carnival gives photographers—amateur and professional alike—an equal chance of getting good shots. There is no press area and you are free to go where you want—as long as you do not get in the way of the competitors.

Lifesaving *A 180 mm telephoto allowed Nigel to get in close.* **Ready to plunge** *A blue graduated filter on a 20 mm lens darkened the sky.* **On the waves** *Without a long telephoto—here a 400 mm—subjects would be too small*

Nigel Snowdon

What went wrong?

Pet pitfalls

Pets can make attractive and appealing subjects for photographs, but they are notoriously difficult to photograph well

Cats are very independent, and in the hurry to get shots it is all too easy to miss a distracting background or choose a dull, eye level viewpoint

When a cat looks towards you its face is no longer in focus, as here. To avoid this, prefocus on its nearer ear before attracting its attention

Remember to include detail that gives the viewer the whole story, and wait for some action—this shot should show a cat toying with a frog!

In dim light, dark coloured animals are difficult to photograph—shoot outdoors or use fill-in flash or other lighting

Even when shots appear to have worked, it is worth taking a couple more—the animal is bound to move and the new position could be even better

82 TReLK.

Wildlife at night

With careful planning, the right equipment and a knowledge of some night photography techniques, you can avoid pictures of wildlife at night ending up as fruitless shots in the dark

Jane Burton/Bruce Coleman Ltd.

Nocturnal birds and animals make a particularly challenging subject for the photographer. Not only are they active during the hours when most of us are asleep, but they are also hidden from our eyes by darkness. The very fact that this section of the animal kingdom is normally invisible makes it that much more interesting when we see it in photographs.

The challenge lies in securing these pictures against what might seem to be formidable odds. Most wild creatures try to avoid human contact if possible and, to take photographs, you must take them by surprise. This can be particularly difficult at night—many animals see better at night than we do, and have highly developed senses of smell and hearing. Furthermore, such simple photographic tasks as focusing the camera can prove almost impossible in the dark, and camera controls must be operated by feel rather than by sight.

None of these difficulties is insurmountable, however, particularly if you have a knowledge and understanding of the creatures you plan to photograph, and the patience to wait silently and motionless until they appear.

Blinking orbs *The direct flash on the photographer's camera picked out a dramatic glint in the animal's eyes*

Equipment and materials

Surprisingly little extra equipment is needed for night shots of animals and you can use most cameras, providing they are quiet in operation, and easy to use in the dark. It is often possible to set up and focus the camera during the day, so complex viewing systems are not necessary and a 35 mm rangefinder or a 6 × 6 cm TLR is ideal. If you use an SLR, it may need to be muffled, or used

Douglas Armand/Tony Stone Associates

Possum and young *At night, focusing is a problem, and for this picture, the photographer was aided by a torch*

with the mirror locked up, so that the noise of the mirror is eliminated and the only sound comes from the shutter.

For many pictures, a standard focal length lens is sufficient, and will enable some of the animal's habitat to be included in the picture. For more tightly framed shots, a medium telephoto is more useful. Long lenses are usually impractical—on an SLR they are difficult to focus, and on a rangefinder camera they do not couple with the focusing mechanism. Furthermore, their relatively small apertures can present exposure problems.

Flash is essential for working at night, and if a large area of ground is to be lit, you will need a powerful gun. Flash guide numbers are usually calculated for average indoor conditions, and in an open space you may have to use a wider aperture than usual. If you are using a telephoto lens, you may be able to overcome this problem by using a special condenser lens attachment over the reflector of the flash. This concentrates the beam on a smaller area, and effectively increases the power and reach of the gun.

A single flashgun produces very harsh lighting, so wherever possible use two instead. Use a powerful gun to provide the main or key light, and another, smaller, unit to fill in the shadows. To avoid trailing wires it is best to use a slave cell to fire one of the guns. You will have to experiment to achieve the right lighting balance between the two units, but a good starting point is to have the main light twice as powerful as the camera-mounted fill-in flash. To estimate the correct exposure using this twin flash method, follow the guide lines on the larger flash, then close the lens aperture by half a stop to take account of the extra light from the smaller gun. Try and shoot a few test exposures before going out to photograph a live subject.

Even with flash, some sort of camera support is essential. This frees your hands, and allows you to carefully compose the picture around the spot where you expect the subject to appear. Choice of film depends very much on the power of your flash, and its distance from the subject, but you should use the finest grain film that is practical.

The final choice of equipment and materials depends partly upon what you already own or can borrow, but there are three basic techniques for shooting wildlife at night, and each calls for a number of minor variations in equipment.

Baiting

The simplest way to attract animals for the camera is to put down food regularly in the same place, and be prepared to photograph the animals that come to eat. Use seed and grain for the smaller mammals, or pieces of meat to attract carnivores and owls. Even in a suburban garden, a surprisingly wide range of wildlife can be attracted by this method.

Try and avoid unnatural looking bait such as white bread—this never looks good on photographs. Some kinds of bait, particularly meat, can be mixed with earth, or staked to the ground, so that your subject cannot just pick it up and run off with it. If you are using grain, on the other hand, lay it in a line parallel to the camera back, so that as the feeding animal works its way along the line, it stays in focus.

Mouse and frog *Small animals abound in woodland and long grass, but they tend to be nervous and elusive. For these difficult subjects, you may have to use a special remote trigger, so that the animal itself releases the shutter by breaking a beam of light*

David Hosking

Bat in flight *Fast-moving subjects leave no time for focusing, so the camera must be preset on a fixed point*

The most important thing to bear in mind when laying bait is that most nocturnal animals are timid and wary. It is no good sprinkling crumbs on the ground and expecting immediate results. It may take days or even weeks before the animals get used to a new source of food.

Once you have established that the bait is being taken regularly, you can start to make preparations for photography. First, remove any unsightly rocks, twigs or rubbish, at least a day or two before you take the pictures.

Before it gets dark on the evening of the shoot, set up the camera, making sure that it is downwind from the bait. Make yourself as comfortable as possible, as you may have to stay in the same position for several hours. Try and wear warm clothes that do not rustle when you move, and wear plenty of them—it can get cold at night, even in summer. A car makes a very good place to sit if you can get one close enough to the site.

When the time comes to take pictures, release the shutter using a cable release. A useful type is the pneumatic release, which works at distances of up to ten metres from the camera. Other methods of remote control appear on page 1301.

Unless you are using some sort of automatic trip device, you will need to be able to see the subject. In total

Nonchalant badger *Some species will ignore electronic flash, once they have had time to get accustomed to it*

Adrian Davies

darkness, you can use a torch covered with a simple red filter—cellophane will do—to illuminate the subject. Most animals do not notice a dim red light as long as it is kept reasonably still.

When you are about to take pictures, wait until the creature is relaxed and feeding before pressing the shutter. After this, wait a few seconds before winding on the film, or taking another picture. The noise of the shutter may initially startle the creature, in which case you must muffle the camera, but very soon most will get used to the sound of the camera, and do not react to it.

Prefocusing the camera

If you can find a spot that is regularly frequented by the animal that you wish to photograph, you can dispense with the bait, and set up the camera nearby. This location might be the entrance to its den, a stream where it drinks, or even a favourite tree where it sharpens its claws. When photographing near to an animal's den, you must keep disturbance to an absolute minimum. As with nest photography of birds, the slightest disruption may cause animals to desert their young, or at least move them to a safer place. When setting up your equipment, always avoid treading near the entrance hole, and try to approach silently and downwind. A hide is generally unnecessary, but try and sit against a tree or bush so that your silhouette does not show on the skyline.

Some animals follow very regular hours, emerging at the same time every evening, but others are not so predictable. If an animal has very regular habits, you can photograph it at a number of different places, and soon build a collection of shots illustrating various aspects of its behaviour. In spring and early summer, you may be lucky enough to see the young emerging for the first time. Young animals are more inquisitive than adults, and may come quite close to you, providing a good opportunity for close-up pictures. Do not be tempted, however, to touch or stroke the animals, because not only will you leave your scent on them, thus running the risk of their parents deserting them, but you may also be bitten.

When trying to photograph this sort of activity, you will probably need to move and refocus the camera quickly and quietly. This may at first seem difficult, but with experience and practice, it becomes surprisingly easy. Get to know your camera well—remember which way to turn the focusing ring if the subject moves closer, or use the focusing techniques described on page 653. Also make a note of the direction in which the aperture ring must be turned to stop the lens down. Only by becoming thoroughly familiar with your equipment can you hope to respond quickly when animals move around.

Stalking for pictures

Of all the methods of photographing wildlife at night, stalking is by far the most difficult, and least likely to yield an acceptable result. Any animal in its own environment is able to see and hear far better than you can, and knows the terrain much better. On the other hand, you may gain the occasional shot of animals which cannot be photographed by the other methods.

You will need to carry a camera, a flash and a torch. It is possible to mount the torch on the camera or strap it to the barrel of the lens to make it less cumbersome, but a more convenient solution is to use a caver's helmet with a lamp fixed to it. This leaves your hands free to operate the camera. Use a long lens, and a tele attachment on the flash.

It is sometimes possible to follow an animal along a path once it has become

Lone owl *Night pictures often need powerful flash units to prevent dark subjects merging with the background*

Francois Merlet/Atlas Photo

Hans Reinhard/Tony Stone Associates

preoccupied in its search for food. Animals may scratch the ground looking for roots and grubs, and often become oblivious to observers, and it is then that you can take a picture. The animal will probably run off when it sees the flash, so you may only get one picture.

Never relentlessly pursue an animal just to get a picture. At certain times of the year food supplies may be limited, and by continually following the animal, you may cause it to go hungry.

Whenever walking through the countryside at night, either stalking or returning home, be very careful where you tread. Woodland paths are often slippery and fraught with obstacles such as tree roots which can easily be overlooked at night. Before you set out, tell someone where you are going, and what time they should expect you back. Walk the route in daylight first, and get to know any potential obstacles.

If you have never tried photographing animals and birds at night, then make a start by laying bait, and use this method to get to know more about wildlife and the photographic techniques involved. Local natural history societies should be able to offer you help and encouragement, and with patience, skill and good luck, you should be able to produce interesting and informative images.

Hedgehog family *Even in your back garden, regular baiting can attract good subjects—these hedgehogs were lured by a saucer of milk.* **Coyote** *In wilder areas, a regular supply of meat soon brings larger mammals*

Frank W. Lane

Movie editors

Movie editing equipment allows you to select parts of a film, remove others, and create completely new sequences. Here, we look at the equipment involved and how it works

Dave King

Stereo editor *This sophisticated model has facilities for dubbing and mixing film shot on a sound camera*

When you shoot a movie, however short, some of the scenes may be wrongly exposed, badly framed or out of focus. Furthermore, the order in which you originally shot the movie may not be the most effective—scenes might benefit by being shortened or rearranged. There is no reason why you should keep to the original order—you can improve the result by *editing* the film. But for smooth, undetectable joins, you need the right equipment.

Using proper editing equipment you can cut sequences which are technically unsatisfactory, and rearrange the order of whole scenes, making the movie smoother running and more concise. You can also juxtapose scenes which were originally unrelated, giving them new meaning and emphasis. If you want to produce a longer movie than the standard three-minute amateur running time, you can splice films together up to almost any length.

For all forms of movie editing, you really need two basic items of equipment: a *splicer* for cutting and sticking together lengths of film; and an *animated viewer or editor* to determine exactly where to make the cuts—though you can make do with a splicer (and a projector) if you are not aiming for sophisticated results.

Many models of splicer are available, some costing as little as a roll of black and white film and others as much as a medium telephoto lens. But all work on the same principle—after the film has been cut, either with scissors or by the splicer itself, the two ends are held in position by the register pins on the splicer, and then joined together carefully. This must be done very accurately if the join is not to be noticeable during projection. There are two basic splicing techniques—wet splicing and dry splicing—and each calls for a slightly different range of equipment.

Wet splicing

To wet splice a film, the splicer's cutters automatically trim the ends of the film so that they overlap neatly, and they are then joined together by a quick drying solvent cement. Since this cement only acts on the base of the film, a small strip

Wet splicing with cement

1 *When a cement splice is made, the ends of the film must first be scraped—this film splicer has two scrapers*

2 *Once the ends have been scraped, the cement is applied—on some splicers automatically, in this case dosed by hand*

3 *The newly cemented join, held in the film holder, is flipped over and pressed firmly, creating a strong splice*

4 *A correctly made cement splice should be strong, neat and should hardly be noticeable during projection*

of emulsion must be scraped from the end of one piece of film. The cement can then be applied and the two film ends pressed together. Cement splices are cheap to make, and if properly done are hardly noticeable in projection.

On most splicers, the scrapers are worked by hand and if you use too much pressure, you may make a splice which fails after a few projections. With practice, you can learn how much pressure to use, and at least one model has a battery driven scraper which removes exactly the right amount of emulsion for a strong join.

It is important to use the right amount of cement in wet splicing—if you use too little, the join will be weak, and if you use too much, it will be messy. One splicer has a device which doses the cement exactly, to produce a firm, neat and very strong joint.

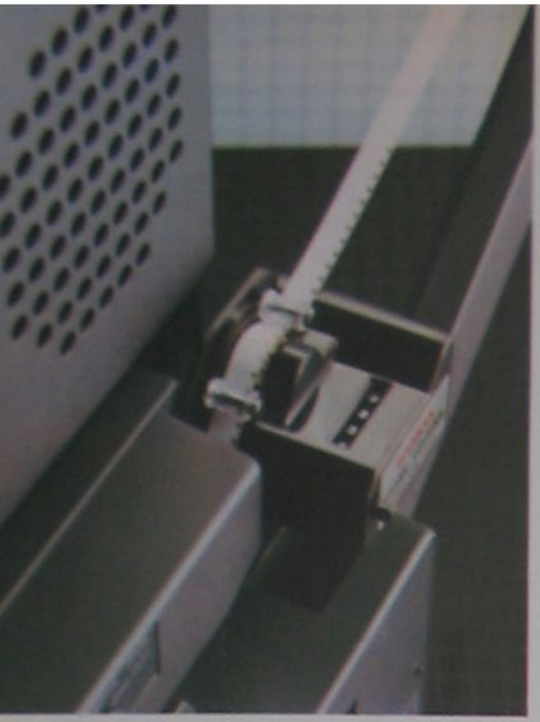
Unfortunately, the thickness of the overlap can cause the image to go out of focus during projection, and can interfere with the magnetic soundtrack. For this reason, many splicers make *tapered* or *bevelled* joins—both ends of the film are scraped, so the resulting overlap is hardly thicker than the film itself. It is worth spending a little more to buy a splicer that can make joins of this type. Splicers with a single scraper are less convenient than those with twin scrapers, which can scrape both ends of film at once.

The join between two lengths of film is always made at the frame line, so that it is not noticeable during projection. It is worth checking, however, that the splicer makes the overlap in such a way that the dark line produced covers the bottom of the frame. Since this part of the picture is usually darker anyway, the join should be hardly noticeable.

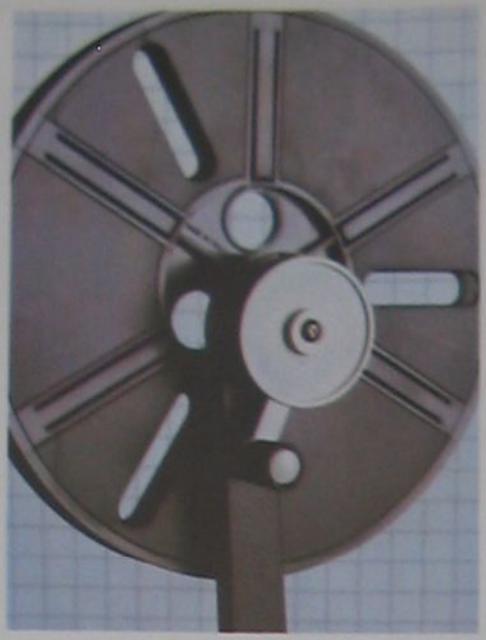
Dry splicing

In a dry splice, the two film ends are not overlapped, but held together with a special clear splicing tape, coated with a non-oozing adhesive. This tape is automatically cut to the right length, leaving the soundtrack area uncovered on the base side of the film, allowing the sound to be played back uninterrupted.

Since wet splicing cannot be used for polyester based films such as Fuji Single-8, these have to be dry spliced. This system is also used with films which can be wet spliced, because it has a



Frame counter *When editing certain scenes, it is important to be able to count frames with complete accuracy*



Geared spool *Rewind handles on a film editor should be geared, one high for rewinding, the low for viewing*

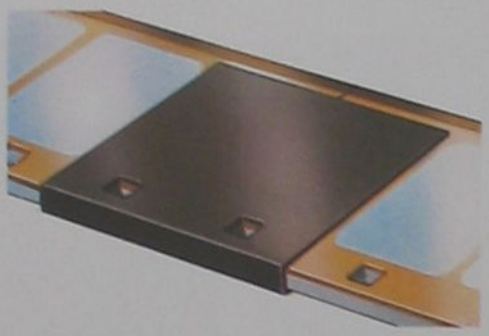
number of advantages—the splices are stronger and faster to make, and you can also detach the film ends and re-splice them without losing a frame each time, as you would with a cement splice. A dry splice does not need to be left to dry, which is important when many splices have to be made. On the other hand, dry splicing is more expensive than wet. A dry splice can also cause problems on some sound projectors, so it is important to establish whether your projector takes dry spliced film satisfactorily.

Dry splicers are of two types—those that use *plain* splicing tape, and those which take *pre-punched* tape. Plain tape splicers incorporate punches, to punch holes in the tape to coincide with the film perforations. Plain tape is cheap and easy to use, but it can be difficult to punch the perforations accurately and tape can get caught in the splicer or the projector. Most modern splicers use pre-punched tape, either in roll form or in pre-cut patches. The cheaper pre-punched splicers can be slow and fiddly to use, and unless you only want to do occasional repairs to film, it is usually worth paying extra for a more sophisticated semi-automatic splicer. Semi-automatic splicers can be very fast to use and some have snap-in cartridge loading for the splicing tape which protects the tape during loading.

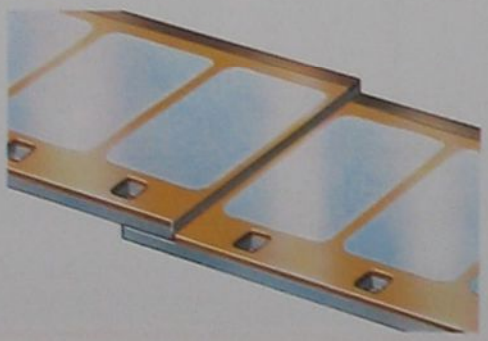
Almost all dry splicers leave the sound track area of the tape clear. There are special patches available which leave the balance track area, outside the perforations, on the opposite edge of the film, clear, for twin track and stereo recordings. These are more expensive and fiddly to use, however, so avoid them unless you work in stereo.

Dry splicing often traps bubbles under the tape which show as blotches in projection, and it is important to eliminate these as far as possible. It is difficult to remove all these in practice, however so for this reason dry splices are more visible than wet ones. By choosing a splicer which only tapes two frames of film, you can minimize this—a four-frame splice is stronger, but more visible in projection.

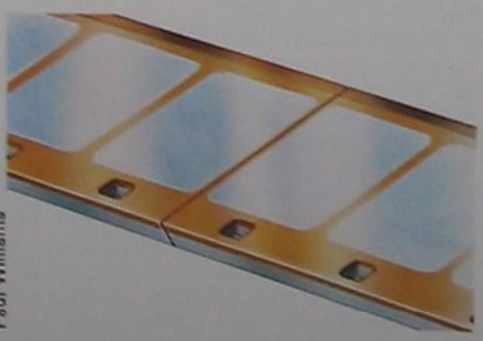
Types of splice



Tape splice



Film on film splice



Bevelled cement splice

Types of splice *A cement splice is twice film thickness. Tape and bevelled splices are thinner*

Paul Williams

Animated viewers

Unless you are simply 'tidying up' your movie, removing faulty sequences, you will need some means of viewing the moving image as you edit it. Although you can do this with a projector, it is slow, tedious and can result in damage to the film. A number of viewing devices are available to allow you to cut off the film exactly where you want it. The simplest of these is an *animated viewer*.

This device produces a moving image on a small screen when you pull the film through it. In order to prevent damage to the film, viewers do not use a claw to advance the film as a projector does, but pull the film continuously over an illuminated area. The film is viewed through a multi-faceted prism block which rotates at a speed that compensates optically for the film's varying speed as it is moved.

With one of these viewers, you can view the film in either direction, or look at a single frame. Since you drive the animated viewer by winding the film through manually, you can control the movement of the film very precisely. When you have decided which parts to cut, you can pull out enough slack to fit the film into the splicer, and make your join in the right place.

Some viewers have a short black-out between frames, which produces some flickering at low speeds. More expensive models use a larger prism and show no flicker—unless you find the flicker tiresome, one of the cheaper models should be adequate for most purposes.

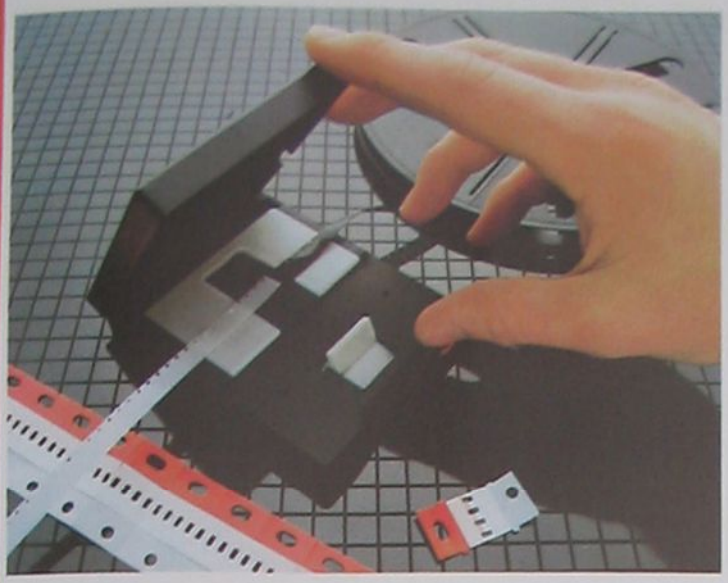
Editors

An editor is simply an animated viewer with a pair of geared rewind arms. The film spools fit on the geared rewind arms, and you can run a whole film at any speed you want.

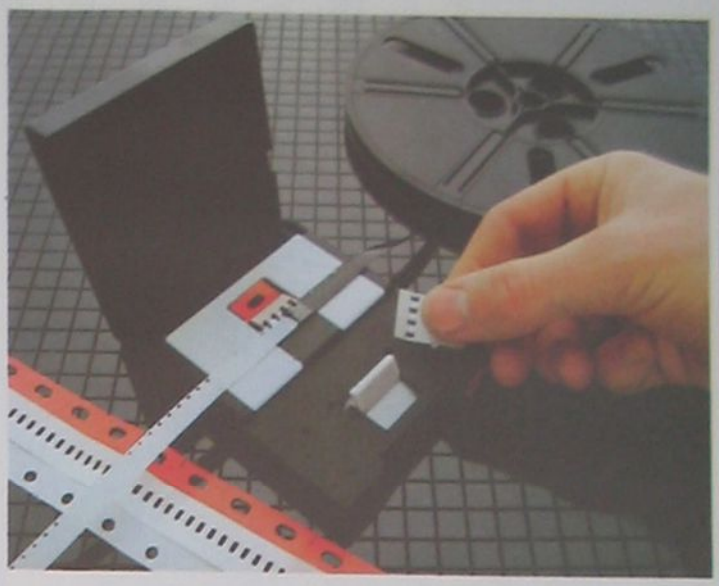
There are a number of points to check when buying an editor—the more comfortable you feel when operating it, the better. The spools should be at least as large as those you plan to use for projecting, and the film should run smoothly through the film path, which should be free of obstructions or rough edges. Make sure that the film travels through the editor in the same position as it does through your splicer—that is, with the sprockets towards the operator or away from the operator, otherwise you will have to twist the film every time you make a splice.

The image in the editor should be as sharp and bright as possible, and it must

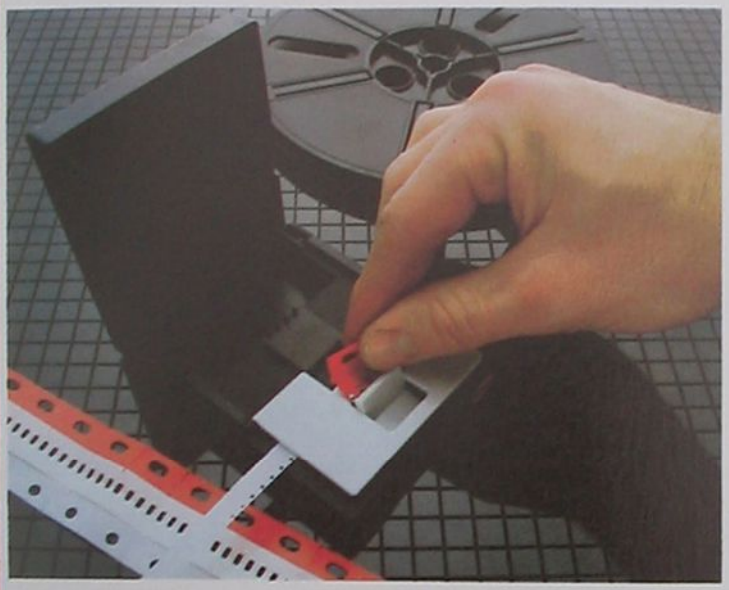
Dry splicing with tape



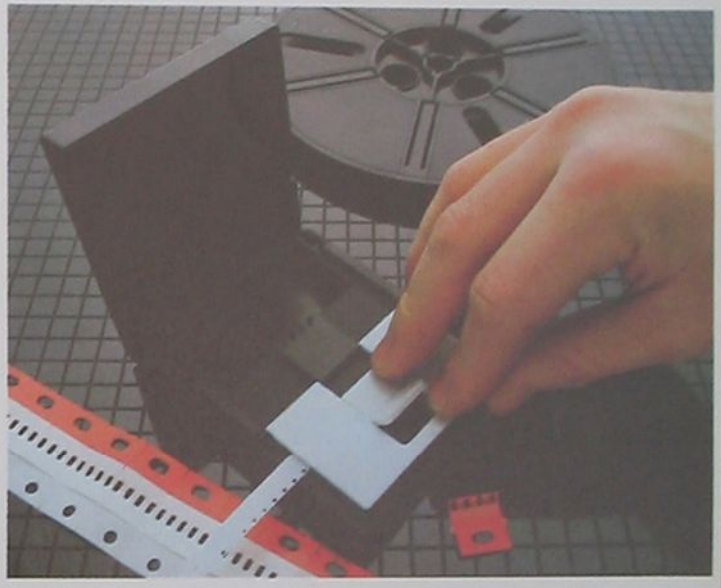
1 *The film is cut by a blade under the hinged black part of the splicer, and the two film ends lined up ready to join*



2 *While the film is held in position, part of the backing on the self adhesive tape is removed, ready for sticking*



3 *The film is flipped over, sticking the tape on one side, and the backing on the other side is removed from the tape*



4 *The film is again firmly pressed, sticking the second piece of tape. A splice made in this way is transparent*

Dave King

stay in focus when you view a single frame. Most editors have a punch which makes a small 'nick' to mark the point where you want to cut the film. It is preferable to have an editor which marks the film at the precise point, rather than two or three frames away. If you do not use this system, you can simply mark the film with a wax pencil, though this is less convenient. Another point to check when buying an editor is the gearing of the rewind handles—the right hand one should be geared down, to allow the film to be viewed without jerks, while the left hand one should be geared up so that you can rewind the film quickly.

With a good quality editor, there is virtually no limit to the changes and improvements you can make to films.

Motorized and sound editors

It is not easy to wind the film manually at the right speed, so it is sometimes difficult to judge the length and pace of the scenes. Some motorized editors can wind the film at different speeds—as the take up spool fills up, you have to decrease the speed of the winding motor. It is essential that the editor should have a facility for disengaging the motor drive, allowing the film to be rewound manually.

Motorized drive is essential when you edit sound films, because you must be able to hear the sound track when making cuts—indeed, this is often more important than the image itself. Some editors have a facility for converting to sound editing—you can fit a small unit, containing a replay head and an amplifier connected to an earphone, on to an accessory shoe. You can then hear the sound track as the film is pulled over the head.

Special sound editors drive the film by means of a rubber-covered capstan, at a constant speed of 18 or 24 frames per second. These give good quality sound, and allow you to judge the length of shots and the pace of the sound track with absolute accuracy. Although they are convenient, they are considerably more expensive than other types.

What you buy depends on the work you want to do. If you just want to make your films smoother running, a simple splicer and editor are adequate—it is surprising how much you can do with these. For more advanced work, though, you need more sophisticated equipment.

Understanding...

Acutance

The sharpness of the final image depends ultimately upon the performance of the film and one of the best ways of assessing film performance is to measure acutance

K. J. Davidson

Biting sharp *High acutance developers keep the picture looking sharp even at high magnification, though the enlargement shows how they also increase graininess*

Although a good lens is clearly essential for sharp photographs, good film is important as well. While for lenses, the most significant measure of sharpness is the MTF (see pages 1100 to 1101), with films *acutance* is also very important.

At one time, it was usual to measure the sharpness of a film in terms of resolving power. But resolving power only tells how much fine detail the film can record, not how sharp the pictures look. Yet some pictures look extremely sharp—and this is, after all, what most photographers want—even though they do not resolve the finest detail. Acutance provides an accurate measure for this sharp appearance.

Edge sharpness

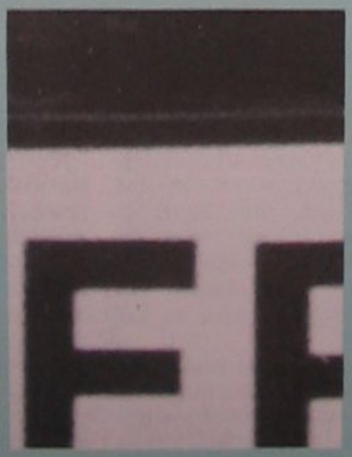
In any photograph, it is the edges of areas of tone that contribute most to the visual impression of sharpness and acutance is, essentially, concerned with how sharply edges are reproduced. Surprisingly, perhaps, tones do not end abruptly, but fade gradually into each other—even when a jet black ruler is photographed against a white background, the edge of the ruler is recorded on film as a minute transition from black through grey to white. The more abrupt the transition, however, the sharper the picture, and acutance is basically a measure of the steepness of the tone transition at the boundary between two contrasting areas.

Even with the sharpest pictures, the transition is often less sudden than might be expected. You can see this for yourself by exposing a film through a narrow slit in an opaque mask. When the film is processed, the image of the slit will nearly always appear wider than the slit itself. In addition, the more exposure you give, the wider the slit becomes. The image does not end sharply at the edges of the slit but extends into the unexposed area beyond it.

This spreading of the image is caused by reflection and refraction of the exposing light as they hit the emulsion surface, and also by diffraction and dispersal of the light by the silver halide crystals. In fine grain emulsions the main cause is a particular form of scattering, known as *Rayleigh fourth power scattering*. Rayleigh fourth power scattering occurs when the size of a crystal is roughly the same as a particular wavelength of light. Because fine grain emulsion contains a high proportion of tiny crystals, this form of scattering is very common—though the effect varies from colour to colour. With faster, coarse grain films the spreading is largely a result of reflection and refraction though there is some scattering as well, all of which contribute to lower acutance with fast films.

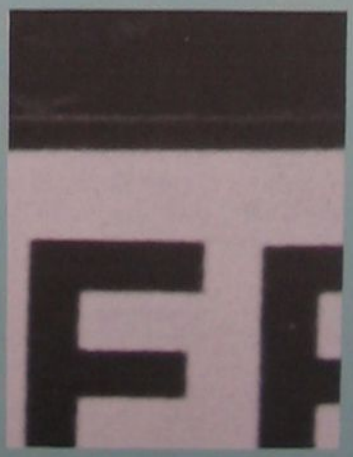
The sharpness of the image thus depends on the cloudiness—or *turbidity*—of the emulsion. If you look at a piece of undeveloped film you will notice that it has a milky appearance. This diffuses the light and can lead to a loss of sharpness.

The effect of this diffusion on the image—called the *photographic* turbidity—is not always the same as the



David Gordon

Low acutance *Soft edges caused by diffusion make the image look unsharp*



High acutance *Fairly abrupt tone changes give a sharp high acutance image*

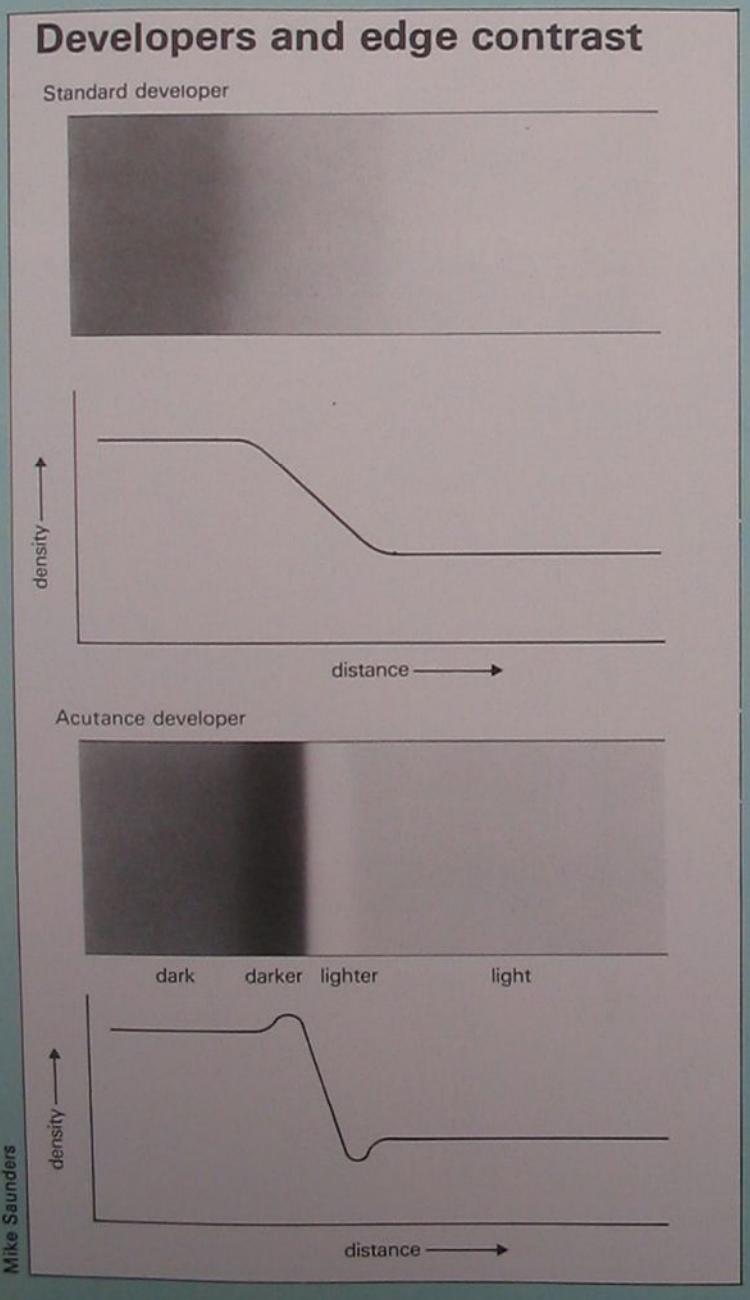
visual effect—the *optical* turbidity. This is because various techniques are used when making the film to reduce photographic turbidity in order to obtain maximum sharpness. One such technique is to use a thin emulsion layer, though this introduces other problems.

Another method is to dye the emulsion yellow. This has the effect of absorbing some of the blue light—to which the emulsion is particularly sensitive—preventing it from penetrating deep into the emulsion, although this method cannot be used with panchromatic films.

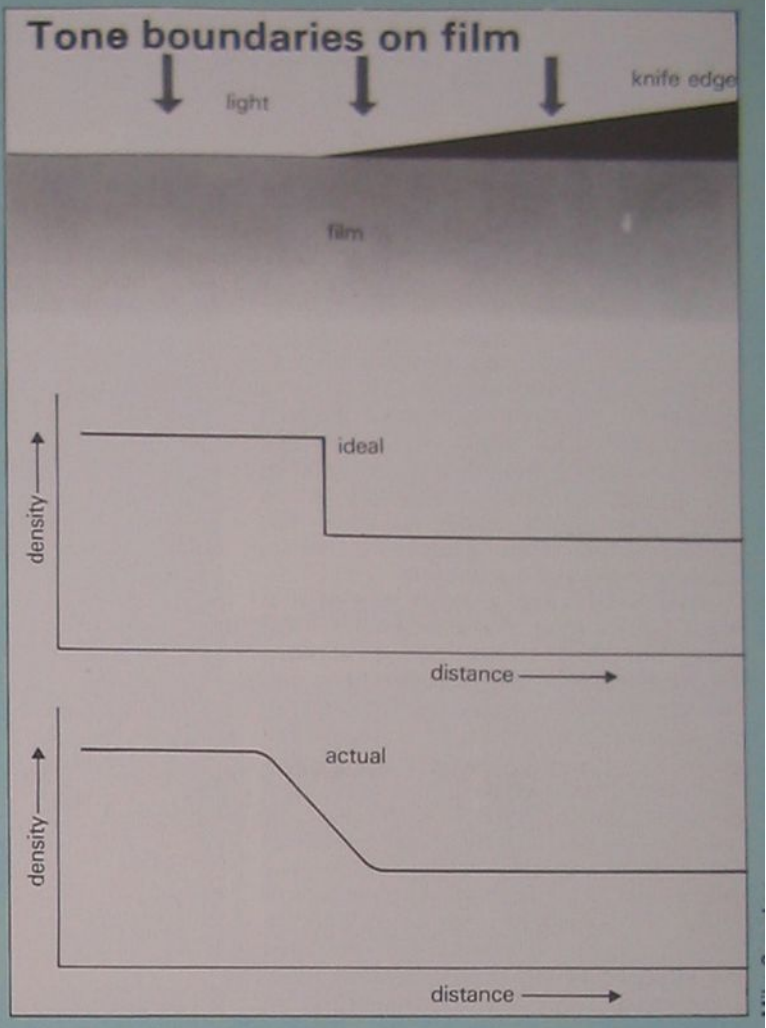
It can be seen that the acutance of a film depends largely upon the emulsion type and, normally, a slower film gives sharper results. The main reason for this is that slow films have thinner emulsions and finer grain than fast ones. Over-exposing or over-developing also reduces acutance.

Measuring acutance

To measure the acutance of a film the exposure and development are standardized. The film is exposed to light using a knife edge to mask part of the film and produce a sharp boundary between the exposed and unexposed areas. After development the image densities across this boundary are measured using a *microdensitometer*, an instrument capable of measuring tiny areas of a film. These values are then plotted against distance and the gradient of the resulting graph gives an indication of sharpness, and a value for acutance is calculated mathematically.



Mike Saunders



Acutance developers *restrain development on the light side of tone edges and increase it on the dark side*

Boundaries *Even a knife edge placed directly on the film gives a gradual tone change, not the ideal abrupt line*

Developing for acutance

It is this boundary area which is affected by 'acutance' developers. Such developers exploit what are called *adjacency effects*. Where a heavily exposed area of emulsion adjoins a less heavily exposed one, active developer diffuses sideways from the area where little development is taking place and increases the rate of development in the adjoining heavily exposed area.

At the same time, exhausted developer loaded with soluble bromides diffuses from the high density area to the less heavily exposed area and restrains development, reducing density at the edge of the latter. This produces what amounts to an outline effect which, if it is extreme, can be objectionable in big enlargements.

High acutance developers of this kind make use of an active developing agent, such as Metol or paraminophenol (see pages 1604 to 1605), which is sensitive to the restraining effect of bromide. In addition, the working solution of the developer is dilute and exhausted quickly.

Other developers are sometimes used which only form a surface image and do not produce silver in the depth of the emulsion. As the scattering of light is more severe at the back of the emulsion than at the front, the result of producing an image at only the front surface is to increase sharpness. However, as not all of the grains are used to give the final image, there is some loss of speed and contrast.

High acutance developers are rarely effective with fast films because the clumping of grains produces a less definite edge.

For maximum sharpness, a film with high acutance must be used. But such a film, even when used with a high acutance developer, can never make up for lack of sharpness in the lens.

Creative wide angle

Wide angle lenses can do much more than produce wide, distorted views; their pronounced perspective effects and enormous depth of field can help you make unusual creative images

In the search for a new approach in photography it is much easier to resort to a gimmick, such as a coloured filter or a distorting lens, than to think of a genuinely creative technique. It is a great pity that wide angle lenses, particularly of the ultra-wide variety, are abused so often in this way, when they have much more to offer the photographer than simply a wide, distorted view of the subject.

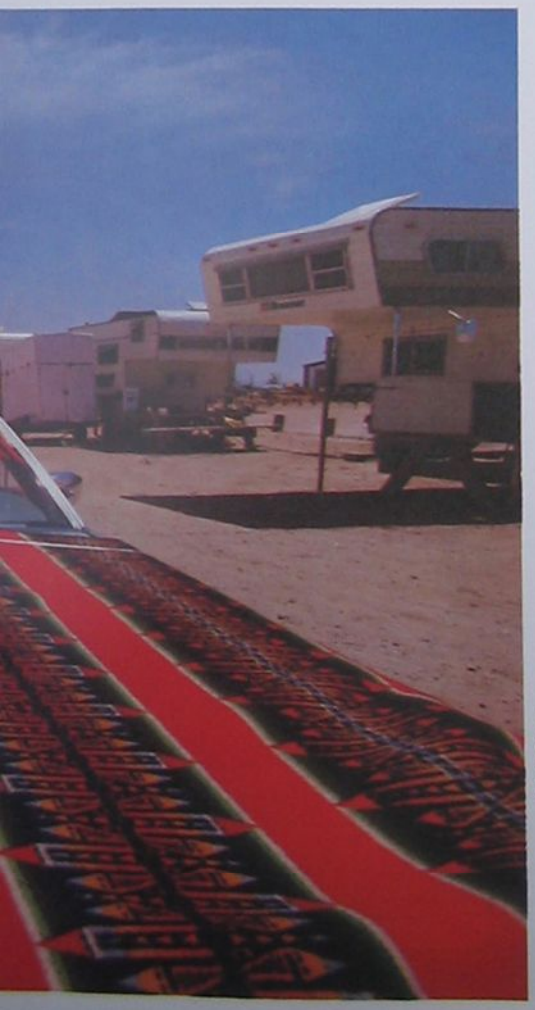
Most people can actually see over a wider angle than the widest ultra-wide lens, but only really notice a very small area. So a wide angle view can sometimes surprise and intrigue simply by including elements of a scene that would not normally be noticed. Even a moderate wide angle panorama of a broad landscape, such as a 28 mm, may include foreground detail or elements that people normally fail to see. A view of a sunset, for instance, may include a deep blue sky overhead, as well as the golden glow around the sun that held the attention in the original scene. With a standard lens, this rich contrast might have been lost. A snowscape, on the other hand, may include the texture of footprints in the foreground which contribute towards the success of the final image.

One of the most valuable properties of the wide angle is its great depth of field which allows you to include close foreground detail in a generally distant scene while keeping both perfectly sharp. A photograph which is composed in this way can draw the viewer into the picture, creating a sense of involvement. For instance, you may have, as your subject, a sideshow at a fairground where there is a small crowd of spectators. Instead of standing in the front row for an unobstructed view, or shooting from a higher viewpoint at a distance with a telephoto lens, try shooting from within the crowd with a wide angle lens, so that two or three spectators frame the sideshow on either side of the photograph. Anyone viewing the picture is made to feel part of the crowd in this way. In other situations you could use trees, a window, even a hole in the wall as a sharp frame for your picture.

Apart from using foreground objects simply to lead the viewer into the picture, you can add considerable interest to your compositions by choosing these objects carefully so that you create a relationship between near and far elements in a scene. A foreground rock, for instance, can not only lead the eye towards the mountain landscape in

G. Boutin/Atlas Photo

Sergio Dorantes



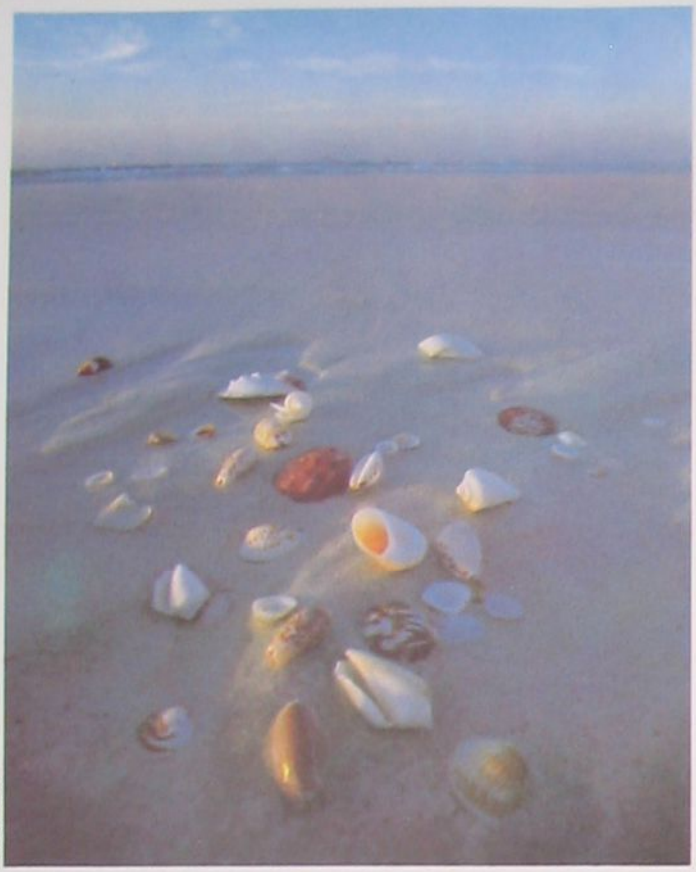
John Sims

Aircraft *With a low viewpoint, an ultra-wide angle has a dramatically distorting effect on any subject*

Striped rug *A wide angle can change a foreground detail into a feature of significant interest*

Hotel *Even a moderately wide angle lens can transform a modest structure into a more impressive building*

Pumpkins *When used close to a subject, a wide angle enables you to fill the frame entirely, without a background*



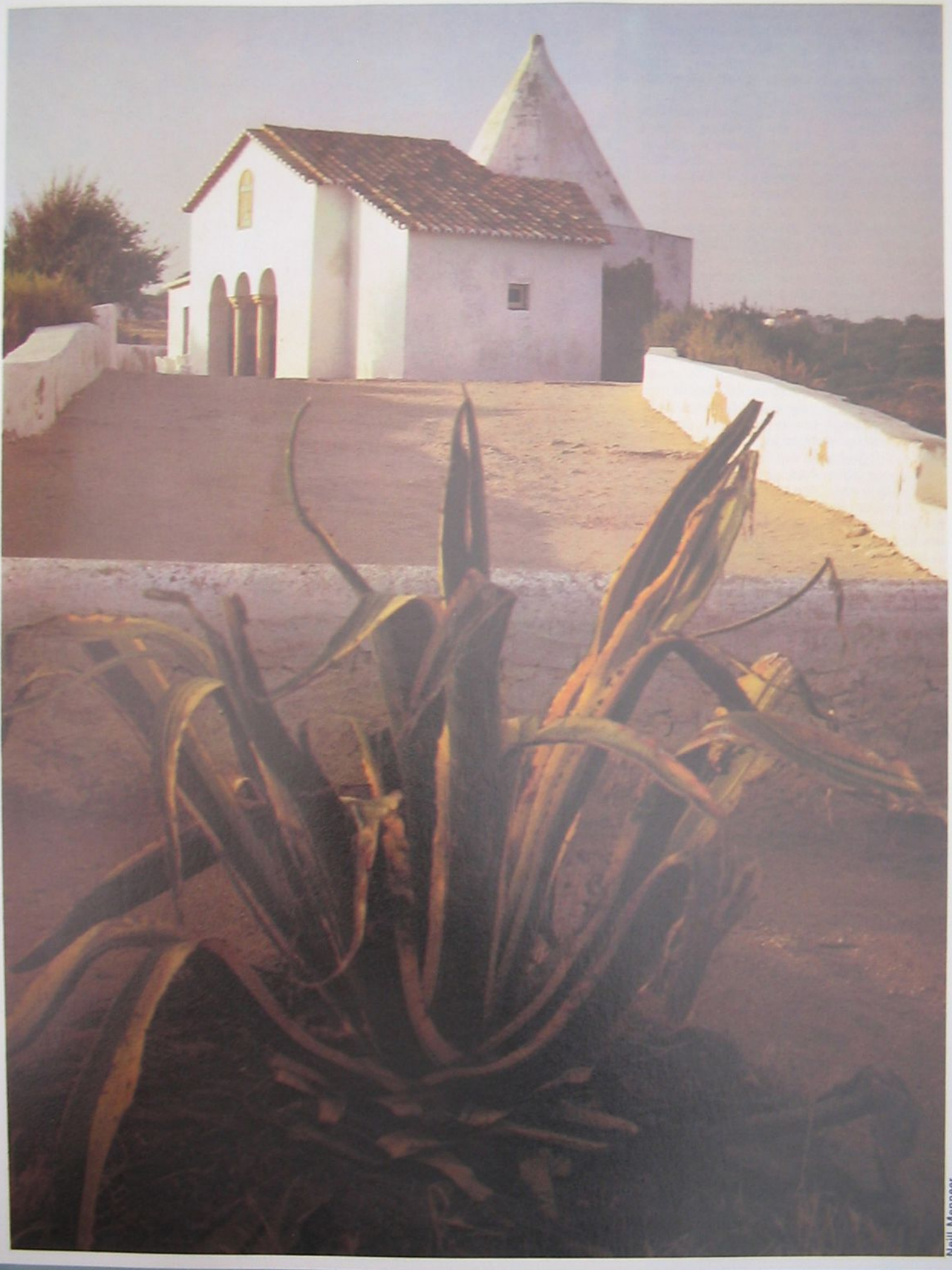
Robin Bath

Robin Bath

Shells *The great depth of field of a wide angle allows you to include a sharp horizon in a close-up shot.*
Black hats *You can make an interesting feature from a wide angle's ability to emphasise foreground features.*

Lupins *A carefully selected viewpoint with a wide angle creates different angles from simple vertical lines.*
White church *The 'classic' wide shot—establishing a relationship between near and distant subjects*

Robin Laurance



Neill Menneer

the background, but also gives an idea of the scale and structure of a mountain. An isolated car in the foreground could make a background desert or open prairie appear more lonely and desolate than it really is.

Alternatively, you could use this technique to illustrate an idea or story—for instance, a single lonely seedling growing in the ashes of a forest fire. The enhanced perspective of the wide angle lens will exaggerate the size of the smaller foreground subject relative to that of the background, and you can discover some interesting visual juxtapositions in this way.

While wide angle lenses increase your view of the overall scene, at the same time they alter the effect of perspective in a picture so that the foreground seems to dominate the picture.

One famous photograph by Art Kane made excellent use of this emphasis on foreground. In a portrait of the boxer Joe Louis, Kane posed his subject with his remarkable hands clenched on his knees, and by shooting from a close, low viewpoint he made the fists dominate the image, as they had dominated Louis' life. In this case the photographer used the specific characteristics of the wide angle lens as a creative contribution to his subject.

In the same way you could position someone who is working at a potter's wheel, for instance, so that the wheel, the unfinished pot, and their working hands dominate the picture by occupying a foreground position. This is a particularly useful technique to use when dealing with shots of people at work, when you want to emphasize what they are doing, whether it is a portrait of an architect, a master chef or a child painting.

Clearly, to make the most of this effect, you need to choose your viewpoint with great care. A view from over a balcony, for instance, is unlikely to contain any foreground details, and so the sense of depth is weak. However, you can move your viewpoint so that the balcony forms part of the foreground, giving a very marked sense of perspective to the picture.

With a wide angle, small changes in viewpoint make enormous differences to a composition, and it is worth exploring each different aspect fully. You can, in fact, choose a detail for the foreground of one picture, and then, by moving around a little, choose another detail without altering your background.

If small changes in viewpoint make such large differences to the composition, extreme viewpoints, such as those given from the top of a wall, or from close to the ground, have an extraordinary effect. A wide angle used from the ground can make nearby people look like giants, for instance, or it can create fantastic landscapes out of a small piece of earth. You can often provide a new way of looking at a familiar scene with a wide angle, such as a rabbit's eye view of its own habitat, in which flowers and grasses loom high over the lens. A simple brick can appear as an immense tower block if your viewpoint is close enough.

Quite apart from appearing to change the size and shape of the subject, the strengthened perspective given by a wide angle lens tends to produce images that have more pronounced diagonal lines. Compositionally, diagonals help to give vitality and a sense of movement to an image, and in some situations a dull subject can be made to appear more interesting by using a wide angle lens. This technique is popular in commercial photography when the subject has to be made into as lively an image as possible. You can pick out a minor feature, such as a path leading up to a church, a rope attaching a boat to its moorings, or the shadow of a figure, and turn it into a significant point in the composition as a strong diagonal leading the eye towards the main subject, and sometimes striking right across the frame. Generally, wide angles work best with symmetrical objects, such as the front of a train.

Ultra-wide angles have become notorious for their ability to distort images, but, when used with care, an ultra-wide angle or even a fisheye lens can give a fascinating new view of a commonplace subject.

Ed Buziak

Windmill *The enhanced perspective effect enables you to make a strong feature of a diagonal line*

Georg Gerster/John Hillelson Agency

Flamingos, *Lake Baringo, Kenya. Over half the world's pink flamingos breed on these East African soda lakes.*
Kansas fields *The whitened fields are ploughed in great sweeps to help preserve them from wind erosion*

countries, there are virtually no suitable craft. In Tunisia, for example, Gerster has found that, for a specific project he is planning, there is only one suitable aircraft in the whole country and this belongs to an oil company. If he wants to use it for his photography he first has to clear all his flight paths with the Tunisian Air Force.

At one point in his career Gerster travelled frequently to Iraq to photograph archaeological sites. 'There was an aircraft that was not airworthy, so I had to arrive with two plane tyres for it. Later I brought a carburettor into Baghdad in my hand luggage. They asked all sorts of questions. Finally, after about five trips, the plane was repaired and we did a three-day trip. The pictures from this trip are still the basis for most people who want to illustrate the major sites in Iraq. All coming from that crazy trip.'

Gerster likes to work with pilots who get as much enjoyment out of the landscape as he does. 'I have a pilot in Idaho that I use very often. That guy understands what I'm doing to the degree that he looks out the other side (of the plane) and then points the pictures out to me and says, "There's another, Gerster".'

This also has its drawbacks. Sometimes the pilot gets so involved in what Gerster is doing that the plane goes out of control. 'In one instance someone almost killed us both. He got into a very unstable flying situation because he was rather too concerned with the camera and what shutter speed I was using.'

Gerster usually works from heli-

World of photography

Georg Gerster

Georg Gerster's superb images have revealed a new way of looking at the earth's surface and established him as the world's most famous aerial photographer

There are few specialist photographers who lead a more varied or exciting life than Georg Gerster. An expert in aerial photography, Swiss-born Gerster has travelled extensively over five continents—in all types of aircraft and under all sorts of conditions.

Gerster is over 50 now and his dramatic aerial pictures are well known throughout the world. His subjects may be anything from geological formations to remote African villages but his pictures are immediately recognizable because of their strong graphic qualities.

Despite the thousands of hours that he has spent in the air, Gerster has never yet learnt to fly. He prefers to leave that to others and to concentrate on the photography. Finding pilots and planes suitable for his needs is not always easy. Their availability and the control of the air space in a particular country will depend on the part of the world he is in.

'In the US for instance,' Gerster says, 'there is no problem, as in every small village you find an aeroplane.' In other

copters or very small planes, such as the Cessna—a one-engined, high-winged plane. But sometimes he has to shoot from larger planes and this can create awkward situations. He recalls a flying trip in Iran, where he was using a Britten-Norman Islander. This is a two-engined, six-seater plane on which he had to remove the freight hatch to take pictures. The resulting noise from the engines was so tremendous that he had to have someone sitting halfway between himself and the pilot to relay messages between them.

Unfortunately the system did not work both ways. Whenever two-way communication was needed, the pilot had to cut both engines. 'I can tell you, you start hurrying up what you have to say when you are just sailing over 4,000 metre high mountains! I was always so afraid that the engines wouldn't start again.'

Gerster uses entirely Nikon equipment, 'for convenience rather than out of complete conviction', he admits—the Nikon repair centre is a mere 10 minute drive from his home near Zurich. Considering the wear and tear that his cameras go through this is an important factor. 'I carry about ten Nikons on a job, so I don't have to worry about breakdowns. I put them in my suitcases belly up, like dead fish'.

Normally Gerster has six bodies to hand when he is working—four loaded with colour film and two with black and white. 'I still like to take some black and white—often just for recording purposes.' Each body is fitted with a different length lens, to cut out the time wasted changing lenses. 'One body would definitely have a 180 mm lens on it. Then one would be fitted with a beautiful Nikon 105 mm and another with a 90 or 85 mm'. Although Gerster normally uses a 35 mm as his main wide angle lens, his range of possible lenses goes down to a minimum of a 24 mm. 'If you have a wider angle the struts of the plane get in the way'.

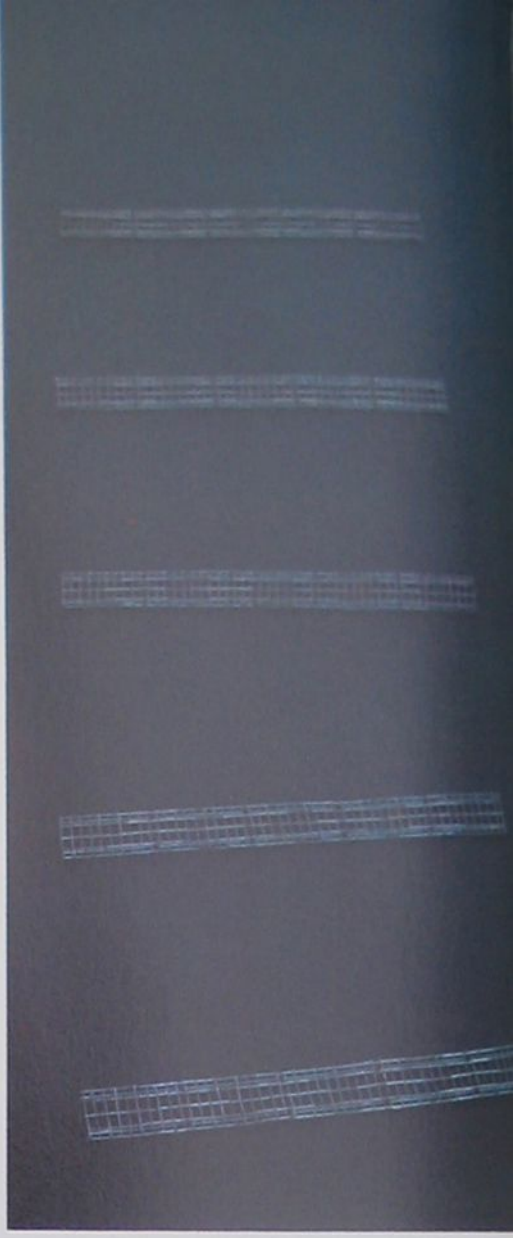
As his subject is so far away, Gerster does not have to worry about his depth of field. His lens is always set at infinity, so he can use a wide aperture and shoot at the fast speeds—usually 1/500 second—necessary when shooting from a plane which is vibrating.

In good visibility, Gerster will usually fly at about 300 metres but, whenever it is particularly clear, he prefers to fly at 1000 metres. At this height he can use a 200 mm lens. He does not like to use anything longer because it means shooting at 1/1000th second to avoid vibration which is too restricting.

Unfortunately visibility is rarely excellent. The earth's atmosphere is full of vapour and minute particles and recently air pollution has become a great problem. Gerster has found that this is particularly bad in the summer and more particularly over heavily industrialized areas, such as the eastern coast of the United States.

Occasionally he is forced to work in extremely bad conditions. 'You look up at the sky and it is beautiful. But once you are airborne you can no longer see the ground any more'. In these circumstances there is nothing to be done except wait. Consequently Gerster tries to make sure that he is given a wide time-span to complete his assignments.

Danish summerhouses *These are constructed around their parking lots so that they look like clusters of flowers on the stems of the highways*



Georg Gerster/John Hillelson Agency

He can then wait for the best conditions.

Time is a very crucial factor in aerial photography, not only because of the incredibly high cost of flying but also because of the speed at which the subject below changes. So Gerster now relies very heavily on using motordrives. Not only do they save time in winding on, but they can be extremely useful in improving the composition of his pictures —particularly where their geometry is of the utmost importance.

'If you have aerial pictures where an axis is aesthetically a strong picture component—for instance, a rooftop or road that runs perpendicularly across the picture—you can never get the axis exactly central without a motordrive. It is too easy to get nervous and shoot your picture too early. Once you have rewound it is already too late. With a motordrive, this is no problem whatsoever. You may shoot perhaps three pictures. One will be right.'

Kodachrome 25 and 64 form Gerster's staple film supply. Kodachrome 25 is his favourite because of its high quality definition. For his black and white pictures he mainly uses Ilford FP4. The quantity of film he shoots for a job is always variable, but usually far in excess of the number of pictures finally used. He has, for example, just finished shooting a story for *National Geographic*.

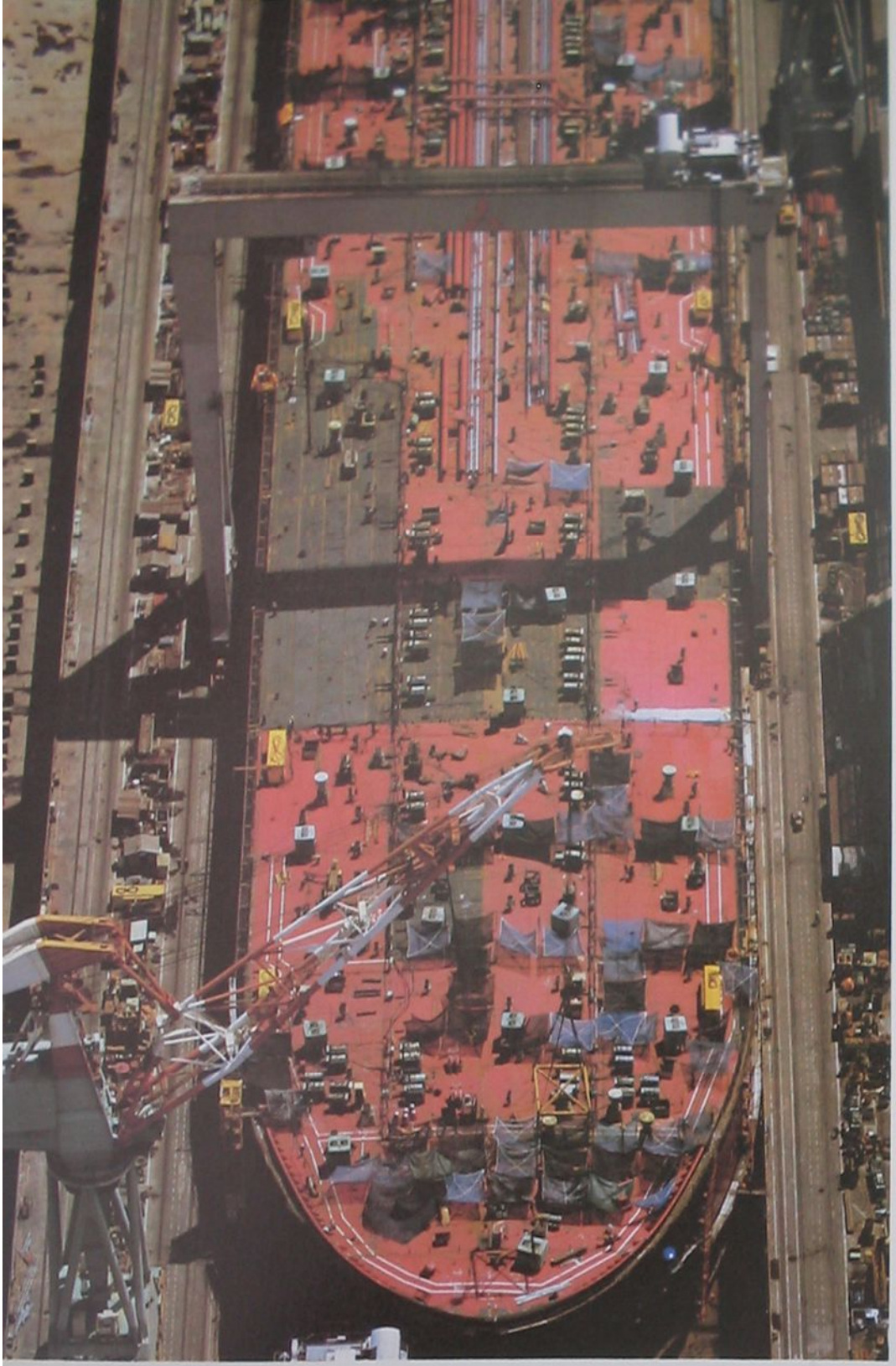
He used over 800 rolls of film, although the final number of pictures used in the magazine will only include about 25 pictures. Although he continually has to cope with haze and constantly changing light, Gerster hardly ever uses filters. 'You can't conquer haze with filters.' He does use a polarizer when necessary —for shiny water and similar reflective surfaces—but he finds that filters hinder his exposure rather than improve the picture quality.

Given ideal weather conditions Gerster prefers to use the first and last two hours of the day, 'especially if I am in a desert, photographing archaeological remains where there are low walls.' The change of light can often alter a landscape so much that a site can be hidden until low light creates long shadows and shows up even slight relief. 'Whenever I fly I always admire the spectacular changes in the landscape in the last half-hour and first half-hour of the day. It is just fantastic.' But on many occasions there will be morning or evening low cloud and he just has to compromise.

Often the best time for shooting is dictated by the lie of the land, or the type of picture Gerster is after. If he wants to place particular stress on colour or texture this will also require different kinds of lighting conditions. 'Ideally one would prefer to shoot against the light to bring out a more lively texture, but then you lose the colour so quickly.' His pictures of salt flats, used in his excellent book *Grand Design* and others, are a good example of this. Here the graphic shapes of colour are all-important and so

Bamboo rafts, *Honshu, Japan. Cultured pearls are bred in the wire baskets suspended under these rafts*

Evaporation spiral, *Mexico. The brine takes 6 months to flow the 30 km to its centre. The dense solution is then pumped out to the nearby sodaworks*



Georg Gerster/John Hillelson Agency

Supertanker, *Nagasaki shipyards. This aerial view shows the vast scale of operations during the construction of this gigantic 270,000 tonne tanker*

require an even light. By shooting when the sun is low, the edges of the dykes around the salt flats cast long shadows, and Gerster has used them to create a completely different type of image.

The majority of Gerster's pictures are used as editorial illustrations in books and magazines, but he also has many commercial outlets, as well as private projects. He always insists on retaining the copyright to his work and will turn down assignments if this is not agreed. He works regularly for such magazines as *Geo* and *National Geographic*, and supplies essays and portfolios to such magazines as *Paris Match, Zoom, Graphis* and the London *Sunday Times* Magazine.

Although his work is 50 per cent commissioned, Gerster prefers to work for himself but with a very definite project in mind. He would rather operate in this way than work at a daily rate partly because he can sell his stories at the price he sets. 'Also I would probably be forced to do things that I don't like to do just because I am being paid a fee. If I have no fee I cannot be bought. I am willing to listen to every proposal but I like to be free to say "that suits me fine" or "this doesn't suit me at all".'

Gerster also works under contract as a photographer for Swissair and provides most of their poster pictures and frequently works on their calendars. But even for them, he keeps to a similar system of working. When he takes a picture on his general shoots during the year that he is particularly satisfied with, he will sell it to them for a set fee.

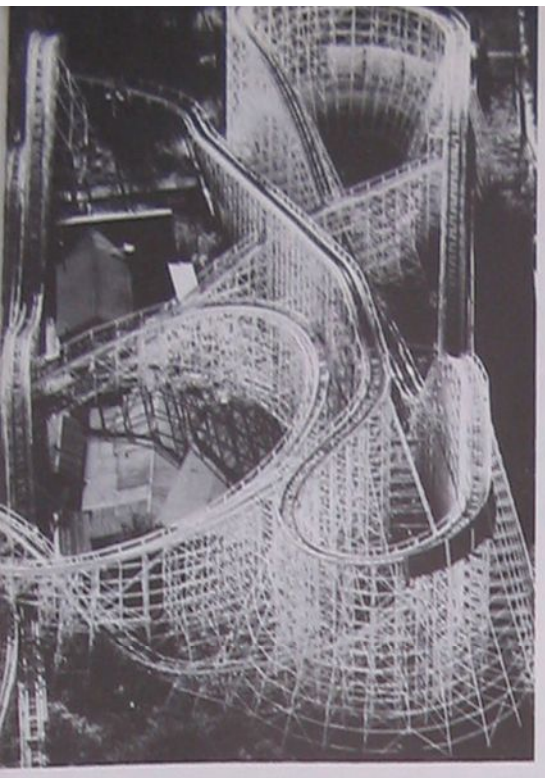
Agents in New York, London, Tokyo, Paris and Germany all have a comprehensive selection of his work. But Gerstar maintains a master-file of what he calls 'the top of the cream'. These slides are kept for special purposes such as calendars, posters or books. Gerster reckons that, with all his costs taken into consideration, each new slide added to this collection costs him around £2,000.

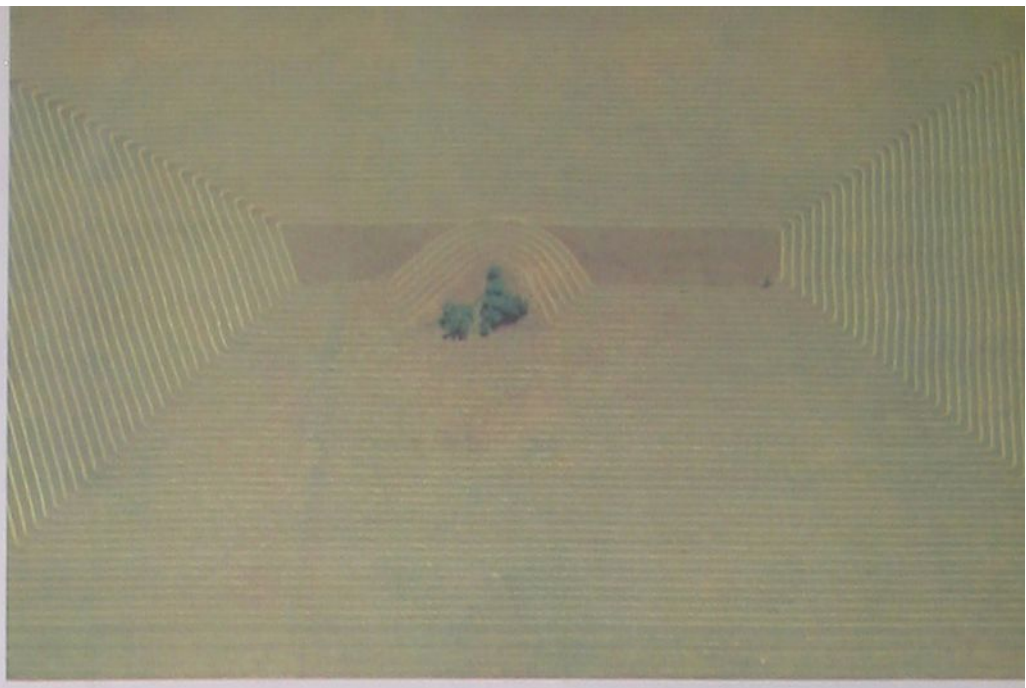
Gerster has many books to his name. They range from scientific reports and books on hidden archaeological treasures to glossy editions of aerial photographs such as *Grand Design* and *Brot und Salz*. He is not only a photographer but a writer too. In fact it was through writing that his career started. 'That's the real work—photographing is just fun.' When he was writing for scientific journals he found that he could never find the right pictures. 'I started trying to take them myself. I learned very quickly, by trial and error.' He still does much of his own writing, especially for magazines such as *National Geographic*.

Although he specializes in aerial pictures Gerster also photographs on the ground but generally only for reportage or scientific purposes. Archaeology, which is one of his private interests, has also become a specialist subject photographically. Since it is now such a popular subject, this has become a lucrative market as good quality pictures are hard to come by.

Gerster is never short of ideas or enthusiasm for future projects. At present

Gorgan valley, *Iran. Here, Gerster has used the late afternoon light so that the long shadows emphasize the sculpted limestone slopes of the hills*





Switchback railroad, *Colorado. When seen from the air this looks like a vast steel sculpture.* **Pampas pattern** *(right) An Argentinian farmer created this beautiful, geometrical pattern during his summer harvest*

he is working for the publisher of a geographical book on deserts. He is also planning to expand his major book of aerial photographs, *Grand Design*. And he has had major exhibitions touring the world, in France, Germany and the US.

Despite all the travelling that he does, Gerster never tires of seeing new places or looking at the way in which man uses the land. He is fascinated by the art that mankind unwittingly creates on the face of the earth. 'What I am wondering about is the decision of taking a picture. How and why do you take this picture and not the other one ? Of course, it becomes so much a routine to yourself that you are not aware of this selection process any more.'

This process of isolating an image out of the mass of patterns below and creating what many would call abstract art makes him wonder about the influence of art on each individual. He finds that modern painting has had a great influence on his work, and wonders whether his pictures would be appreciated if artists such as Paul Klee or Serge Poliakoff had not developed their own special style of painting. He finds it very fulfilling nowadays when other people recognise his photographs in what they see around them. 'The reward comes back to you when other people start seeing 'Gersters'. When you have imposed yourself, your handwriting, on somebody else's vision—that is the highest satisfaction.'

Water hyacinths *in the Phillipines. Clumps of this fast growing plant threaten to clog many of the world's major waterways*

Home-brew developers

If you know how to make up your own developing solutions from the raw chemical ingredients, you can tailor the formulae to produce ideal developers for specific or special needs

For over a century, photographic scientists and manufacturers have been gradually improving films and developers. Grain has become finer, sharpness has improved, emulsion speed has increased and the tone scale has become more suitable for the average subject. For most photographs the popular film-developer combinations are ideal. However, there are unusual circumstances when something different is needed for technical reasons. Furthermore, some photographers like to produce pictures which differ from the norm to emphasize artistic points. In both these cases, using an unusual film developer can be the best way of achieving the desired results.

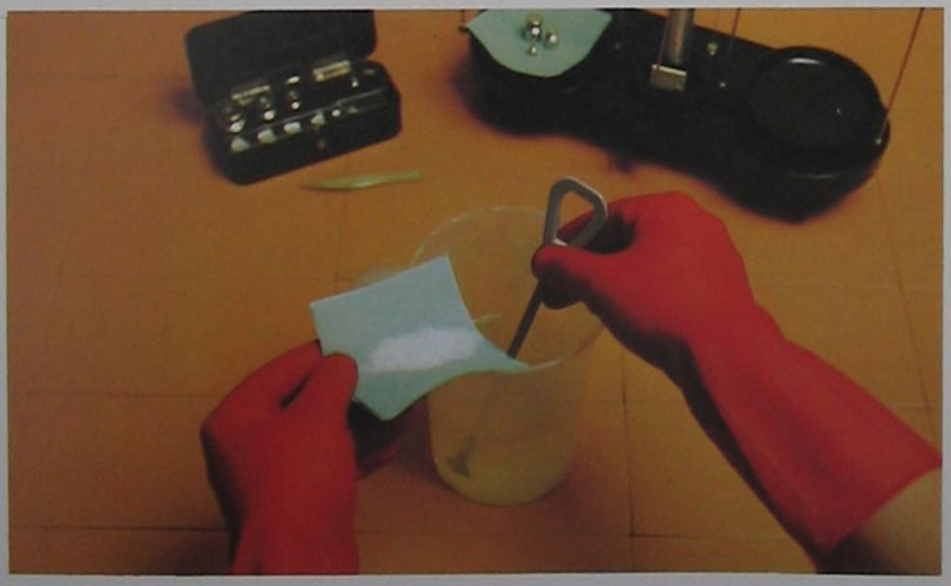
Ordinary developers have been designed to give the best compromise between effective emulsion speed, grain and sharpness, with a tone range suiting the average subject. For special effects the photographer can alter the balance of these qualities, perhaps by opting for finer grain at the expense of emulsion speed and sharpness, or by going for increased sharpness at the expense of grain. The tone range can be altered to suit an unusual subject, or the film deliberately processed in a way that makes grain much coarser.

The various unusual film-developer combinations described here are examples of how the usual balance of developer properties can be altered. In every case some experimentation is desirable since only the photographer knows exactly what is wanted. Modern colour films are not really suitable for manipulation in this way: such creative work is best carried out with black and white films. Often the photographer will find that there is more scope by mixing up developers from the basic chemicals, as only a few special types are available ready-mixed. The functions of the various components of a developer are discussed on pages 1604, 1638, 1664 and 1682, and you may find it useful to refer to these.

Two-bath developers

These have been popular for many years since they tend to be economical and easy to use and they can be made to produce interesting results. They consist of two solutions, used consecutively rather than both together. The first bath contains the developing agent alone. The emulsion soaks this up, but little development occurs because the solution is not strongly alkaline. The first solution is virtually unchanged by this treatment and can be returned to its storage bottle for reuse. The film is not

Making your own developer



Making up your own developer solution is not as daunting as it may first seem, but care has to be taken to accurately measure out the various components you use. You must use an accurate chemical balance—and the cheapest of these will cost you about the price of a box of 20.3 × 25.4 cm colour printing paper, a good investment which is quickly recovered if you go in for photographic 'brewing' in a big way. If you do not have access to a good set of scales, perhaps your local pharmacist may be able to help. When mixing the individual components of the developer, ensure that one chemical is fully dissolved before adding another. Use warm (30°C plus) water and mix in the order given.

1 *It is advisable to filter your developer prior to use. You can make a filter from a funnel and a coffee filter cut to fit*

3 *Twist the disc of filter paper to form a cone with the ends overlapped and place the paper in the funnel*

Developer formulae

General purpose two-bath developer

A	Metol	6 g
	Sodium sulphite (anhyd)	100 g
	Total volume	1000 ml
B	Borax	10 g
	Total volume	1000 ml

Time in bath A can be from five minutes for slow (high-contrast) films, to ten minutes for the fastest, at 20°C. The time in bath B is not critical: three minutes is average. Do not rinse between A and B. This formula does not give exaggerated results because some development occurs in the first bath. Grain is a little finer than with Kodak D-76.

This formula gives negatives of good contrast with a wide range of both shadow and highlight tones. 'Punchy' prints are made easily on normal grade paper. Grain size is slightly finer than that obtained using standard ID11. Image sharpness is also very good. Try 7 minutes for FP4

Monobath

Water	750 ml
Sodium sulphite (anhyd)	50 g
Hydroquinone	12 g
Phenidone	1 g
Sodium hydroxide*	10 g
Sodium thiosulphate	90 g
Top up with water to	1000 ml

*Caution—strong alkali

If you have difficulty obtaining Phenidone, try substituting metol. In this formula use 6 g to 10 g metol in place of 1 g of Phenidone. There is some risk of fog if larger amounts of metol are used. The advantages of Phenidone are its better keeping quality and lower cost.

Bob Cross

Although the grain is clearly quite large in the × 40 enlargement shown above, it is smaller than that of some of the other images (all are × 40 enlargements). Some loss of shadow detail is evident in the negative and printing could be problematical in this case

2 Either fold the coffee filter back on itself to fit within the funnel cone, or slit it almost the length of its radius

Ray Duns

4 Pour your developer carefully into the funnel, directing the flow slightly away from the centre

rinsed between baths, so as soon as the second solution, which is strongly alkaline, is poured in, swift development starts.

The developing agent in the highlight regions of the image is soon exhausted, so development stops in those areas. In shadow regions development continues as the developing agent is not so quickly exhausted. The result is that highlights do not block up but shadows have good detail because they have received more development. The second solution is normally thrown away after use, but since it is comparatively cheap this does not matter. By choosing different developing agents and alkalis, various balances between fine grain and maximum speed formulations can be produced.

In general, two-bath developers give negatives that are easy to print, which is useful when the subject lighting range is extreme. Strong sunlight on white-washed cottages and street lighting at night, each with areas of dense black shadow and intense highlights, are typical high-contrast subjects where two-bath developers would be particularly suitable.

Ready-packed two-bath developers have virtually vanished from the market but many standard, readily available powder developers can be used in this way by dissolving the small packet, which contains the developing agents, to make the first solution. Add some sodium sulphate, after the powder dissolves, to act as a preservative. The larger packet, which is usually sulphite and the alkali, provides the second bath. But you will have to experiment with solution quantities and development times in each bath.

If you wish to try out an old formula you have chanced upon, take care when using it for the first time as modern films have thinner emulsions than old ones. These hold less developer when soaked and so the developer characteristics and times may be different.

Monobaths

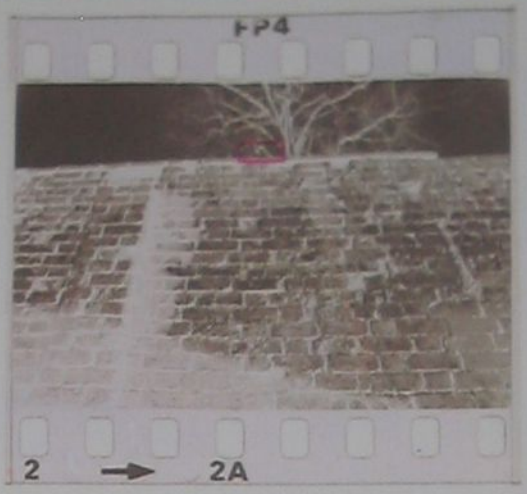
These solutions combine the developer and fixer, as explained on page 1424. Neither time nor temperature are critical and contrast is altered by varying the amount of sodium thiosulphate, in the formula here, between 70 and 125 g per litre. Grain is not fine but sharpness is good. These developers are useful when temperature or time cannot be controlled properly, or if processing must be carried out by an unskilled person. With all monobaths, whether bought ready-prepared or made up from chemicals by the user, the film is delicate after processing so care must be taken in washing and drying, unless you use a separate hardener. Remember when

Fine-grain developer

Water	750 ml
Metol	4.5 g
Sodium sulphite (anhyd)	125 g
Sodium metaborate	2.25 g
Sodium metabisulphite	1.0 g
Potassium bromide	0.5 g
Top up with water to	1000 ml

Sodium metaborate is often obtainable as Kodalk. Development times vary from 8 to 13 minutes at 20°C according to the film. After the first film, increase times by 15 to 20 per cent for each film.

Interestingly, the metol in solution gradually turns purple after it has been added. The solution clears to a straw colour when sodium sulphite is added.



A slightly mushy grain pattern, not unlike that obtained from ID11 used at stock strength, is characteristic of this fine-grain formula. Overall tonality is good in this FP4 image, giving prints of pleasing appearance on normal grade. Try development times of 10, 8 and 12 minutes for 35 mm slow, medium and fast films

Coarse grain developer

Metol	0.5 g
Glycin	0.5 g
Sodium sulphite (anhyd)	4.0 g
Sodium carbonate (anhyd)	50.0 g
Pinacryptol Yellow (0.05% solution)	300 ml
Total volume	1000 ml

If you cannot obtain Pinacryptal Yellow substitute 0.5 g per litre of potassium bromide. Preferably add the dye within six hours before use. The formula gives a 50 per cent increase in effective emulsion speed as well as very good sharpness. Development times are about 12 minutes for most fast films, but up to 20 minutes for Royal-X Pan.

Although coarse grain developer would be better used in conjunction with grainy, fast film, it can be used for grain effects when medium speed films are habitually used. The grain pattern of this FP4 image developed for 12 minutes is crisp and pronounced but the image is much flatter than the others here

mixing that sodium hydroxide is a very strong alkali and should be used with great caution. Heat is produced when it is dissolved.

Extra fine grain

The easiest way to obtain fine grain is by using a slow film with inherently fine grain in the emulsion. However, a special developer can be used which makes grain finer at the expense of film speed. Among proprietary developers of this type are Ilford Perceptol and Kodak Microdol-X.

Coarse grain developers

Photographers sometimes desire coarse grain as a special effect. If your usual fast film does not give coarse enough results, a special formula, such as that quoted above, will enhance the effect. No proprietary developers claim to produce coarse grain.

Speed-increasing developers

Many commonly used developers claim to increase emulsion speed, and most of these can achieve a 60 per cent increase over the quoted values. Even greater increases can be obtained at the expense of grain size simply by prolonging development to provide some contrast increase. But a specially designed speed-increasing developer gives much better results. A proprietary maximum speed developer which is easy to use is Paterson Acuspeed. The formula quoted in the panel is almost as effective.

Make sure that you use a stop bath between developer and fixer baths to prevent chemical fogging.

Special films, not intended by the manufacturers for ordinary photography, are sometimes employed for maximum-speed work. An example is Kodak 2475 recording film which has a normal rating of ASA/ISO 1000 that is pushable to ASA 3200.

High contrast developers

The highest possible contrast is produced with lith films processed in their own special two-part developers. There is no point in making lith developers from separate chemicals as ready made ones are easily available, and long lasting when kept unmixed. Lith films give a high contrast in an ordinary print developer, but not so high as with their special solutions. Lith developers have no special properties with ordinary films.

The camera film with the highest potential contrast is Adox 14, which is made in both 35 mm and roll film sizes. Any caustic–hydroquinone developer will give contrast and a normal print developer may also be used with this film.

Acutance developers

These developers, used with suitable films, enhance sharpness by an edge effect which increases contrast at the borders of tones. The greatest effects are produced using slow, high-contrast films and though the developers do not give fine grain, the inherent fine grain structure of slow films compensates for this.

Adox 14, and to a lesser extent the faster Adox 17, are particularly suited to this technique. Tetenal Neofin Blue and Red developers are specially made for these films. Several developers produce some edge effects, an example being Paterson Acutol used with films such as Ilford Pan F and FP4. Such developers do not work well with fast films. Acutance developers are best used with minimum agitation as this increases edge effects.

For consistent results—important if you are to compare results on a realistic footing—adopt a processing routine which you know you can repeat time and time again. Standardize, particularly, on the method of agitation you employ—two full inversions of the tank each half minute during development should prove suitable. Less agitation may prove beneficial if you are after pronounced edge effects when using acutance developer.

Finally, keep all chemicals safely stored and labelled to prevent accidents.

Speed-increasing developer

Water	750 ml
Methyl alcohol	48 ml
Sodium sulphite (anhyd)	52 g
Hydroquinone	14 g
Sodium hydroxide*	9 g
Potassium bromide	8 g
Top up with water to	1000 ml

*Caution—strong alkali

Industrial alcohol or methylated spirit may be used in place of the methyl alcohol.

High acutance developer (FX-1)

Metol	0.5 g
Sodium sulphite (anhyd)	5.0 g
Sodium carbonate (anhyd)	2.5 g
Potassium iodide (0.001% solution)	5.0 ml
Total volume	1000 ml

Use the prepared solution once and discard. Times are from 11 to 15 minutes at 20°C. For a slight variation you could prepare the once very popular Beutler two-part developer.

Original Beutler developer

A	Metol	10 g
	Sodium sulphite (anhyd)	50 g
	Total volume	1000 ml
B	Sodium carbonate (anhyd)	50 g
	Total volume	1000 ml

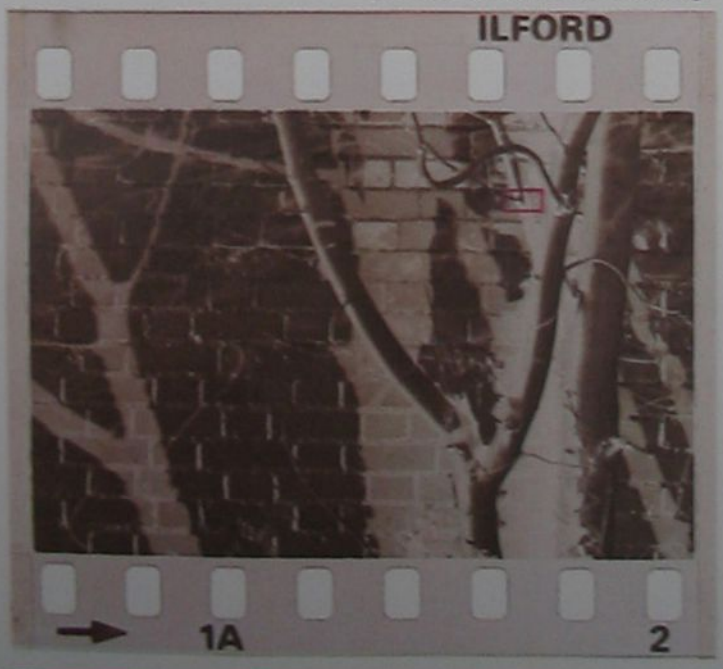
Mix one part A, one part B, with eight parts of water. Developing times range from 8 to 15 minutes at 20°C.

Energetic speed-increasing developers produce contrasty and grainy negs. Although best paired with fast film for a maximum speed combination, a speed-increaser can be used with medium film such as FP4 (here exposed at ASA 400). Six mins development with 1 + 1 dilution was used

Crisp, really sharp grain heightens the apparent increase in visual sharpness of a negative developed in an acutance developer. FP4 was exposed at ASA 200 and developed for 13 minutes. The actual grain size may prove objectionable with some subjects and it may be better to use a standard fine grain developer

How Ilford ID11 compares

FP4 developed in stock ID11 (left) results in a good balance of tones, easy printing very fine, almost mushy, grain, and no loss of film speed—a perfect combination for many photographers. You may like to use ID11 stock solution diluted 1 + 1 or 1 + 3 in the one shot fashion to give (right) slightly better tonal gradation and crisper grain



Assignment

Character study

To achieve more than a mere likeness in portrait photography you have to make a deliberate effort to convey aspects of the subject's character. Here, photographer Chris Barker shows his approach

While the technical aspects of portrait photography are relatively easy to master, it is less straightforward to think of ways to give clues about the character of the subject. For this, you have to decide what you wish to convey in the image, and this demands knowing your subject well enough first. Then, with skilful manipulation of the elements at your disposal—lighting, props, pose, clothing and the setting—you can make an appropriate statement in your images.

For an assignment which would illustrate his approach to portraiture, Chris Barker decided to take individual portraits of his three year old son, Leo, and his nine year old nephew, Sam. Both of them are fairly serious boys and Chris did not want to conceal this facet of their personalities in the portraits. He explained, 'All too often, people force their children into their best clothes, groom their hair and stick them into a bright, strange studio, forcing them to make a smile for the camera. My approach is to do exactly the opposite.'

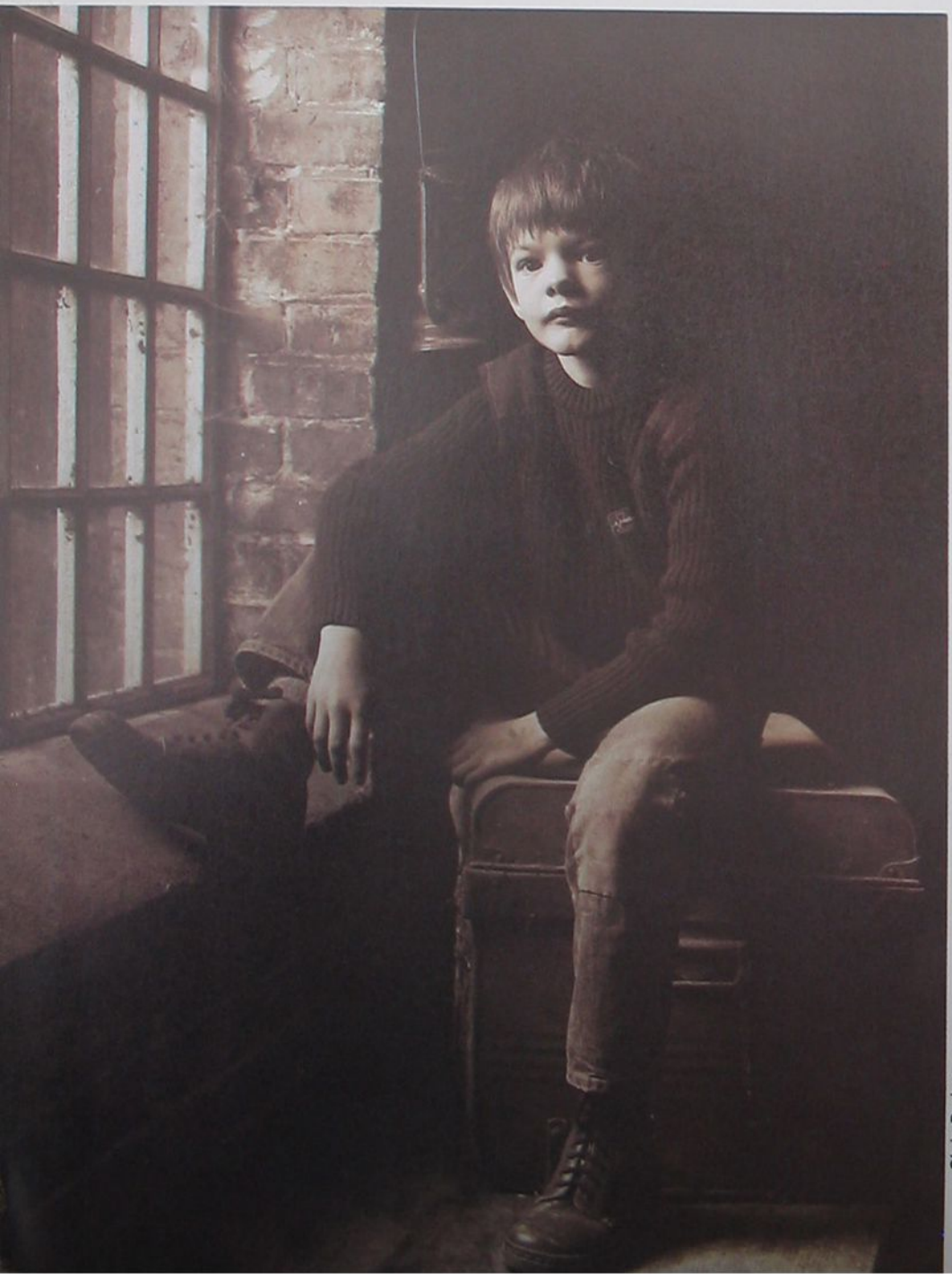
Finished portrait *Chris pre-arranged the set so that he could place his son, Leo, in front of the camera and take a few shots without any delays. He usually finds that the first shots with children are the most successful*

Chris at work *Another version of the shot was tried before Leo's attention began to wander. Chris worked with his large format press camera and positioned the lighting equipment outside the window to simulate daylight*

Chris Barker

Chris wanted the boys to pose in their everyday playing clothes, allowing them to look natural without forcing an 'appearance' for the camera. The familiar settings of an outbuilding near the house helped to add atmosphere to the shots. Although Chris suggested poses, he allowed the children to make themselves comfortable, rather than demanding that they stick rigorously to planned postures.

With Sam, the patched jeans, his badge, oversized shoes and slightly dishevelled hair all convey an honest image of boyhood and an adventurous, independent child. This is further enhanced by the antique surroundings, the textured brickwork and wood, and the ancient trunk—it looks like a private retreat or a place where he is not supposed to be. The same applies to the portrait of Leo, but in this case, the soft image of the rocking horse in the background points to a younger child contained within the boundaries of his playroom. Chris does not like to make props too obtrusive and prefers them to remain as small clues in the picture.



Chris Barker

Flash system *To achieve the daylight effect, Chris used two 850 joule flash units fitted with a single umbrella and triggered by an infrared beam. This allowed him to stop down his 150 mm lens to f/22*

By the window *Compare this study with the other—two quite different character statements despite the similar settings. The warm tones of the image were achieved with Agfa Record Rapid paper and Neutol developer*

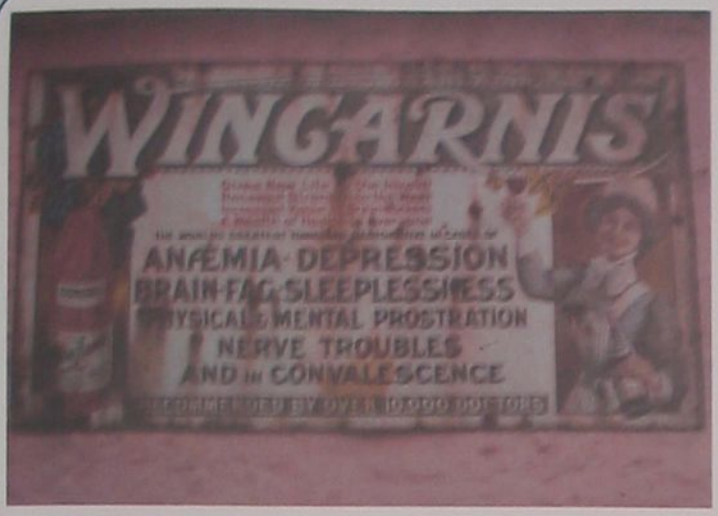
The whole arrangement has to be set up before the child is asked to pose for the camera. To get a child interested in the whole proceedings, Chris often lets them help him setting up the shot—arranging lights and props and even firing the flash units to check the flash meter readings. Chris pointed out 'A child has a very limited span of concentration so you have to know exactly what you want before you start and then just put the child in at the last minute. You can't mess around with Polaroids or anything—you have to get the vital moment in the first couple of minutes otherwise you will lose it. It's no good having a lovely expression in a Polaroid and not be able to repeat it on a negative.'

For lighting, Chris usually prefers to simulate daylight wherever possible. For Sam's portrait he placed his double flash head and large single umbrella alongside the window so that it gave the effect of daylight. Unlike real daylight use an aperture of *f*/22 with his 4 × 5 MPP Mk VIII camera so that he could get the depth of field he needed. For Leo's portrait he simply placed the lights to his left, and above. The large umbrella diffused the spread of light to give soft, even illumination. Finally, Leo used an infrared trigger to fire the flash.

What went wrong?

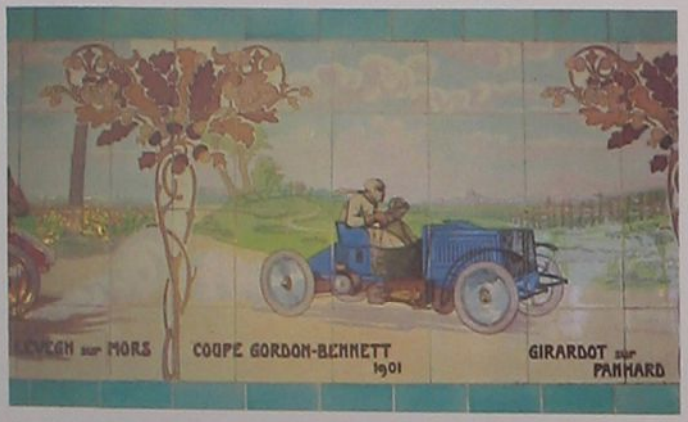
Copying problems

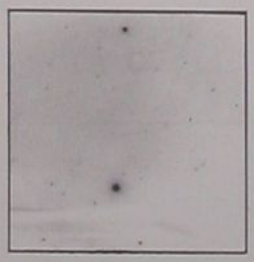
Copying technique is fairly straightforward, but failing to observe basic precautions can lead to images that are spoiled by distortion, poor clarity or lighting problems



Always use a tripod when copying at the slow speeds, especially if you are using the smallest possible apertures for maximum possible depth of field. Learn to recognize your limits as far as safe hand-held speeds are concerned—few people can keep a camera properly still at speeds slower than 1/30 second. Adjust the aperture setting to keep to this minimum or above

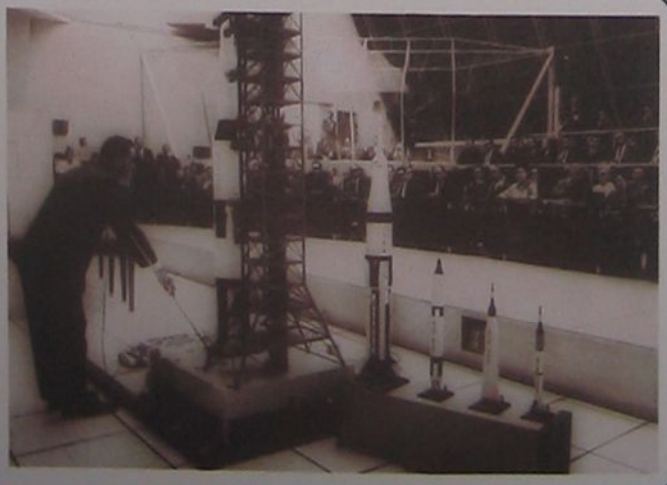
In this shot, highlights on the tripod have been reflected in the glass sheet used to weigh down the book page—frequently something of a problem in such situations. The best you can do is to shield all reflective parts of the tripod, and camera, using black cloth, card or tape





Highly reflective surfaces, such as these ceramic tiles (above), are very revealing of poorly set up lighting—here a badly angled single lamp. The marks on the bases of the images (right) are flash reflections from the lightbox glass on which the pictures (negative star atlas prints) were standing

Insufficient depth of field and a badly aligned camera result in a distorted and only partly sharp image. This type of picture distortion shows that the camera was not square to the copy subject either because the copy was not flat or the camera was slightly tilted



The haziness of the image on this black and white slide, made on panchromatic sheet film without an anti-halation backing layer, is caused by light passing through the film during exposure and rebounding off the printing support easel. The use of black backing card would have eliminated the problem

Assignment

Vineyard

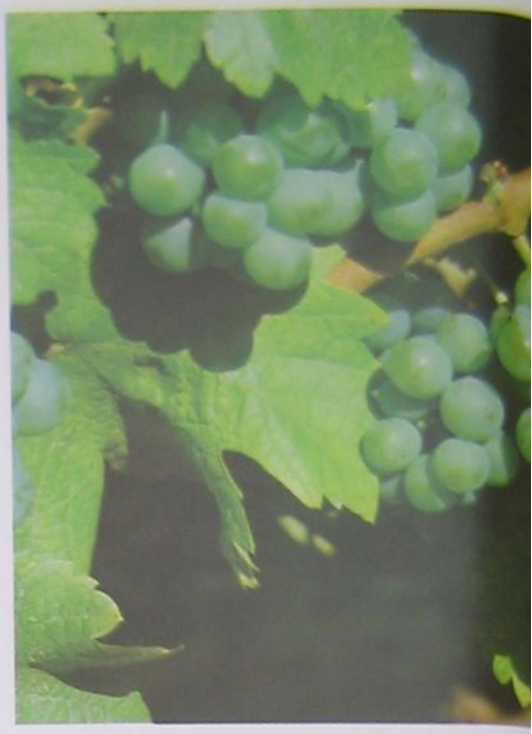
Most travellers stop at vineyards just to sample the wines, but Trevor Wood found that such places also have plenty of other things to please the tastes of a photographer

Throughout the wine growing regions of the world, vineyards open their doors to visitors interested in finding out how wine is made and in sampling the end product. As well as offering a highly palatable insight into the world of wine, these vineyards also make excellent subjects for photography.

While travelling through France, Trevor Wood came across several such places. For this assignment he chose one situated in a beautiful, undulating area and centering upon a traditional French chateau which could be used as a focal point, as in the opening photograph. The proprietor, Baron de Ladoucette, of Chateau du Nozet at Pouilly sur Loire, was more than happy to allow Trevor and his assistant to spend a day photographing their vineyard.

Choosing the right aspects of the place to photograph is fairly straightforward—the chateau itself, the vines, the landscape and the wine tasting. But the challenge that Trevor had to meet was to vary the photographs so that several different images of interest could be produced, rather than ones which would become a repetitive group of images, all with the same feel. As Trevor pointed out, 'The colours of the place were fairly muted—the greens of the vines and the grapes, the earthy colours of the soil and the buildings and the dark tones of the cellars. With less

Chateau *A 300 mm lens compressed the distance between the field and the building, underlining their relationship*



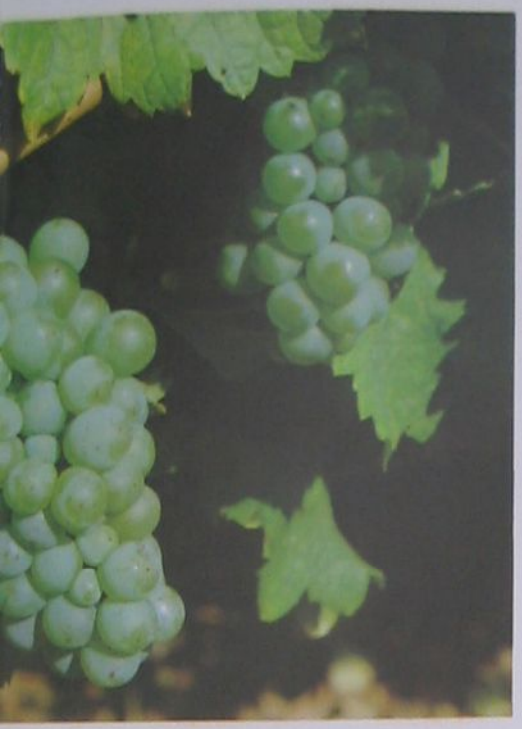
Wine tasting *Deciding that the best way to show the clarity of the Pouilly Fumé wine was to expose for the window light, Trevor thereby created a silhouette effect. 35 mm lens, 1/125 second at f/5.6.* **Fruit of the vine** *Fitting a 50 mm lens gave prominence to the grapes in this shot, but a wide aperture threw the soil out of focus. Trevor would have liked to have had the opportunity to photograph the crop at earlier stages of the year.* **Photographer at work** *Disappointed to find that there was less to photograph in the wine tasting rooms than he had hoped, Trevor arranged his own still life shot. Mounting his camera on a tripod, he used a reflector to get the maximum benefit of the soft, natural window light.* **Still life** *The result of the set-up shot. Shots like this depend upon very careful attention to detail in arranging the individual objects*

emphasis on colour, I had to look carefully for patterns, perspective, shape and form.' The rows of vines receding into the distance, the shapes they make on the horizon, the silhouette in front of the window—are all photographs which do not rely primarily on colour for their impact.

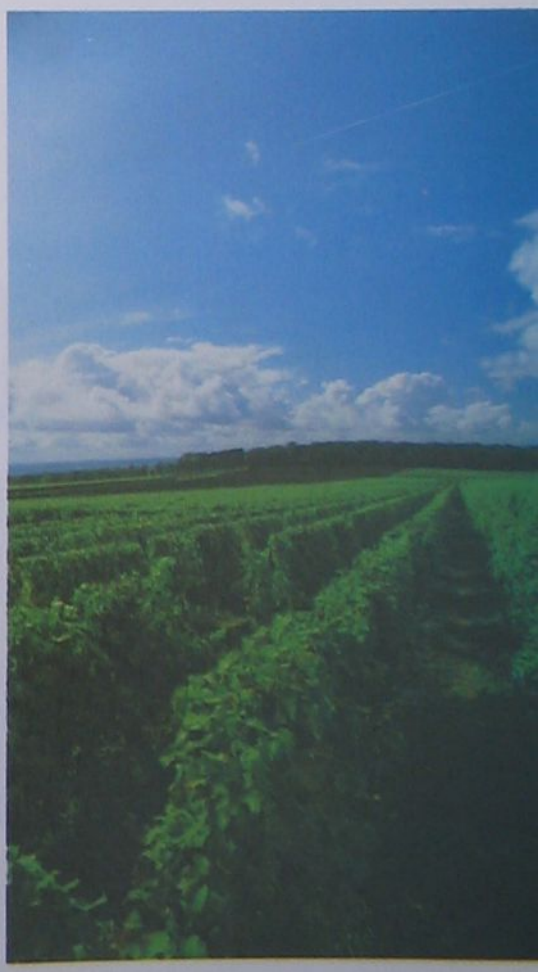
In these photographs, variation has also been created by mixing still life with landscape, interiors with exteriors and by choosing different focal length lenses and viewpoints. Trevor's 200 mm telephoto, for example, compressed the distance between the figure in the field and the chateau behind, giving the building prominence and relating its function closely to the rows of vines.

Trevor found that it was invaluable to have his assistant, Alan, along with him for this assignment so that he could be used as a model. With the introduction of mechanised grape picking there are fewer people to be seen around this particular vineyard.

an Royland



Landscapes *The enormous scale of the place, emphasized by rows of vines receding into the distance were particularly striking. For the shot above, Trevor used a 400 mm lens to accentuate the patterns of the distant vines, including a large area of sky to create a sense of space. While below, a 35 mm lens gave a closer, grape picker's view of the long straight rows. This gives a clear idea of this vineyard's size*



Trevor Wood

Rescuing slides

With a few simple techniques and suitable chemicals, some slides—particularly those that are underexposed or have a colour cast—can be rescued from your waste pile and made into usable images

Most photographers who take transparencies find that they have some shots which would be fine if only they were not underexposed or spoiled by a colour cast. Such slides can often be rescued by using dyes and bleaches, but this is often tackled only by professional retouchers. Just the thought of pouring chemicals over a valuable transparency is enough to make most photographers nervous, but with care and patience it is remarkable how safe and effective retouching can be. Even 35 mm slides, often considered too small for work of this sort, can be greatly improved by judicious retouching.

Probably the commonest cause of poor slides is exposure error. While overexposure bleaches out the dyes in the film, leaving little to work on, an underexposed slide still has all the dyes needed for a good image. And if the slide has had enough exposure to leave a visible image, much of the extra density that makes the slide too dark can be removed with chemical bleaches. While it is unlikely that a badly underexposed slide can ever be brought back to the quality of a perfectly exposed one, bleaching may well make the difference between a transparency that can be used and one that is only fit for the bin.

With a slide that is only a stop or so underexposed, blocked shadows can be opened up and muddy highlights can regain their sparkle, giving a first class slide quite suitable for projection or quality reproduction.

Colour slide film consists of a number of layers—types and makes differ slightly, but they all follow a similar pattern. Since each layer is chemically different bleaches can be formulated to affect any one layer, or suitable chemicals can be made to work equally on all three layers. By varying the length of treatment, the degree of bleaching can be adjusted to suit the needs of each individual slide.

Most modern colour slide films are compatible with Kodak E6 processing and this article is chiefly concerned with these. Other films, such as Kodachrome, have a different make-up and you will have to experiment to see just what works and what does not.

Film manufacturers publish formulae for bleaches for overall reduction in density or reduction of any one layer. These formulae require some unusual chemicals and a knowledge of laboratory procedures. The chemicals can be dangerous and are rarely sold in small quantities. Moreover, many of the solutions have a short storage life, so these makers' formulae are not very suitable for small scale, occasional use. Much more convenient are the ranges of retouching chemicals sold by independent manufacturers such as Colorbrite or Pebeo, who produce the comprehensive Diapocolor range of retouching aids. These have good storage properties and are suitable for occasional small scale use.

Whatever bleaches you use the techniques are very similar. By always working at the same temperature and dilution you will quickly learn to obtain repeatable results. Water used in mixing or diluting the chemicals should ideally be distilled or deionized, although in many areas the water supply should be pure enough to be used straight from the tap.

Preparations

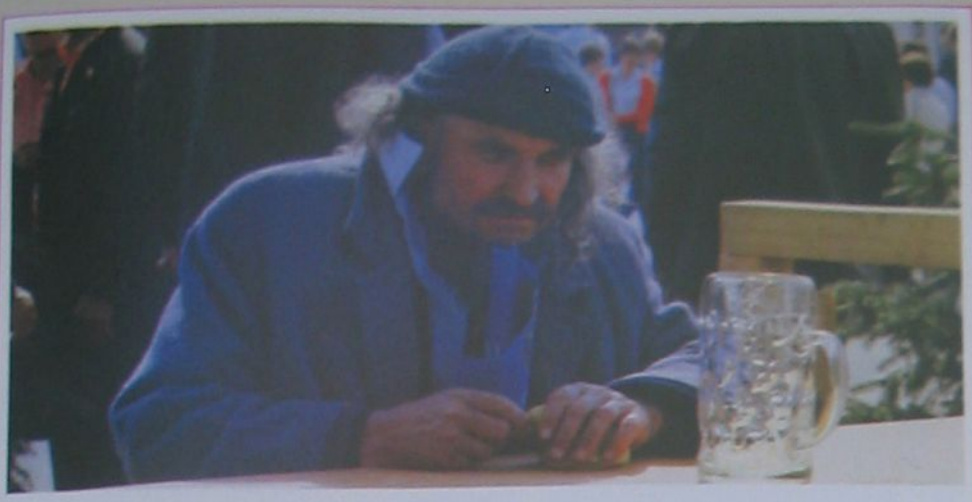
Although a wet slide has different colours from a dry one, it is helpful to carry out bleaching on top of a lightbox. While the exact result cannot be seen until the slide is washed and dried, the lightbox gives an approximate idea of the degree of bleaching achieved, and allows more accuracy when working on a small area of the slide.

To avoid eye strain, cover the unused areas of the lightbox with black paper. If you are very careful, the slide can be lightly taped on to the glass top of the light box and a ring of Plasticine or similar material formed around it to make a dish. This should be sufficient to keep the small amount of liquid well away from the wiring—but do have plenty of

General reduction with overall bleach

David Hoffman

Before and after *This underexposed slide (left) was treated with the Pebeo system to give overall reduction in the density of each layer. Three separate baths were needed, but only small quantities of solution are needed if small dishes are used. The overall cast which this system often leaves can be corrected by reducing individual layers*



Localized reduction *The face in the original transparency was too dark but even on the 35 mm slide it was possible to reduce it using a cotton swab. The treatment can be repeated if necessary*

towelling and absorbent tissues to hand so spills can be mopped up quickly. The one problem with this method is agitating the slide properly throughout the whole of the bleaching stage. If they are available, Petri dishes (thin glass saucers used in laboratories) are very handy. These are shallow enough not to waste too much solution on each slide, yet allow the slide to be moved quickly from one solution to the next. Plastic tweezers are very useful for handling the slides, but remember that the emulsion is very soft when wet, so grip the slide by the edges only.

Some of the chemicals react with metal so if brushes are used to apply the bleaches you should take care to keep the metal part of the brush dry and watch out for any sign of staining. Except for fine work, cotton wool balls or cotton buds are most convenient for applying and removing solutions, as they do not react with them.

Before you begin bleaching, it can be useful to examine each of the three layers of the emulsion separately so as to judge just what retouching is needed. To do this you need a red, a blue and a green filter (Wratten 25, 47B and 58). The yellow dye layer transmits red and green light so if you examine the slide through the blue filter this layer will appear darker and the other layers lighter. Similarly, the green filter will show the magenta layer and the red filter will allow you to examine the cyan layer.

The change in appearance of a wet slide makes a practice run vital to find out just how long to treat the slide. You should use a reject slide of the same film type and preferably of the same batch to make your tests. Allow the slide to dry before judging the effect.

Each bleach stage takes only a minute or two, so it is very important that the bleach is quickly and evenly absorbed by the slide. To resist the high processing temperatures and protect the emulsion, modern slide films have a hardened gelatin surface layer. Soaking the slide in a wetting agent such as Kodak Photoflo of Pebeo Detaning Agent softens this layer and allows quick, even penetration of the emulsion.

A simple reduction in overall density to correct underexposure requires an overall bleach that affects all layers of the emulsion equally. If the first treatment is not sufficient you can repeat the process as required. Avoid too much reduction, which may reduce the sharpness and contrast of the slide. Many of the reducing formulae are reversible—for example, the effect of Pebeo overall reducer can be countered by regenerating the colours in a bleach bath of the type used in the original development of the slide.

A slide with a colour cast requires selective bleaching of one or two layers to restore correct balance. Any overall bleaching may introduce a slight colour cast itself, so do this first, bearing in mind which layers you will be selectively reducing later, to end up with the required density. For example, if you need to remove a green cast as well as reducing the overall density, you will later be reducing the yellow and cyan layers. This will also lighten the slide, so keep this in mind while you are using the overall bleach. Check the instructions too, to see if the order of selective bleaching is important. For instance, yellow bleach may regenerate any cyan already bleached, so the yellow must be bleached before the cyan.

As with overall bleaching the process can be repeated several times to reach the balance required. Some reducers can be reversed if you overdo things, but others are permanent, so make careful tests, and control mixing, timing and temperature accurately.

When you are deciding on the final colour balance in your photograph remember that a slide that is a little too warm in colour usually looks better than one that has too cool a balance. Use flesh tones as a guide—if these look right then the slide as a whole will usually be acceptable.

Reducing individual layers

The original is improved by the use of yellow bleach (top right). Cyan layer reduction (lower left) and magenta layer reduction (lower right) introduce unacceptable colour casts on this example

David Hoffman

Local reduction

There is no need to treat the whole slide—overall and selective bleaches can be applied to parts of the emulsion to give local reduction of one or more layers. Underexposed foregrounds or shaded faces are typical slide problems which can benefit from local reduction.

For sharply defined areas of detail which you wish to reduce, it is best to mask off the rest of the slide. Waterproof tape and even ordinary adhesive tape can be stuck to the emulsion and carefully cut away with a scalpel. Plastic or rubber masking material can be bought from art supply shops. These include liquid masking agents which are painted on to the slide, and removed with solvent or by peeling off with sticky tape when the work is done.

If you want a softer edge, to blend in the retouching, then you should use a paintbrush or small cotton wool swab to apply the bleach. Use the bleach a little more concentrated for this, and go through several cycles of bleach and rinse for shorter times, gradually 'building' the bleaching effect to avoid forming an edge to the work. But make tests first, on unimportant slides, as you may find concentrated bleach affects more than the layer you are working on—especially if it is used at a higher temperature. If this is the case, dilute the bleach.

Permanent image removal

Whole areas of the emulsion can be removed leaving parts of the picture free standing beside the clear base of the film. This can be very useful for pictures with simple outline subjects where the background is cluttered or dull, or where you wish to sandwich the slide with another one. The method is not reversible, as the treated parts are washed away permanently. Carefully mask those parts of the image to be retained using waterproof tape or masking compound, then make up a solution of 5 g of sodium hydroxide in 10 ml of water added to 60 ml of household bleach. Apply this, using a cotton wool ball, to the unwanted parts of the emulsion. It takes two or three minutes to remove these—the treated slide is then given a three minute wash before drying.

After a slide has been bleached it is difficult to predict how stable the image will remain. Some bleaches are not permanent and the slide may return to its original state or develop a colour cast after a time, depending on storage and viewing conditions. The bleaching process may also have an effect on the untreated layers of the film and may affect their stability too. For safety's sake, make a copy of the retouched slide, so you have an image of normal stability.

Adding colour

There are several ways of adding colour to a slide. The simplest method is to sandwich a piece of gelatin filter with the slide. A pale magenta filter reduces a green colour cast, or a light blue filter could be used to create a cooler feel.

Although quick and easy, this method has the drawback of affecting all densities equally, so that the same amount of density is added to highlights as to the shadows. A pale filter has little effect on the dense parts of the slide, and so will not correct any colour cast there. Even a pale filter will dominate the highlights—they will pick up a cast and may appear muddy—so this method is only suitable for subjects with a narrow tonal range.

Instead of filter gels you can use coloured dyes to retouch a slide. Like gels they add the same density to all parts when they are used for the whole slide, but they can easily be applied locally with a brush. You can dilute and mix them to give precisely the result you want. There is no need to apply the dyes to your original transparency—a piece of undeveloped fixed film can be bound up with the slide and the dyes applied to the emulsion of this instead. This avoids risk to the original slide, though there may be a slight loss of sharpness. This

Robinson/Brown

Slide retouching kit *The Pebeo Diapocolor kit for retouching Ektachrome type film, consisting of baths for both overall and individual colour layer reduction. Masking paint and solvent are useful additions to any retouching kit*

Localized colouring

David Hoffman

If you take care, dyes can be used to add colour to drab slides, but this is rather noticeable on 35 mm format

can also be a useful technique when a heavy concentration of dye is needed and the emulsion alone cannot absorb enough.

When using dyes it is essential to work on a lightbox with fluorescent tubes which give a balanced mixture of red, green and blue—a colour temperature of about 5000 K. If the colour balance of the light you use for retouching is wrong, then the slide will not look right when projected or printed. Philips Graphica 47 or General Electric Chroma 50 fluorescent tubes are very good and household Deluxe Cool White (but not ordinary Cool White) are fairly close to the right balance.

If the slide film has a back coating (all large format films do) it is best to apply the dyes to this. They will not come into contact with the emulsion and so the risk of chemical interaction is removed, and the slight separation caused by the thickness of the film base softens the edges of the brush work. Heavier concentrations of dye can be built up using both sides of the film.

There are various makes of dye available. Kodak produce yellow, magenta and cyan dye concentrates. Pebeo have a larger range which also includes red, green, blue, brown, black and flesh. While all these can be mixed from yellow, magenta and cyan you may find it more convenient to buy them ready mixed.

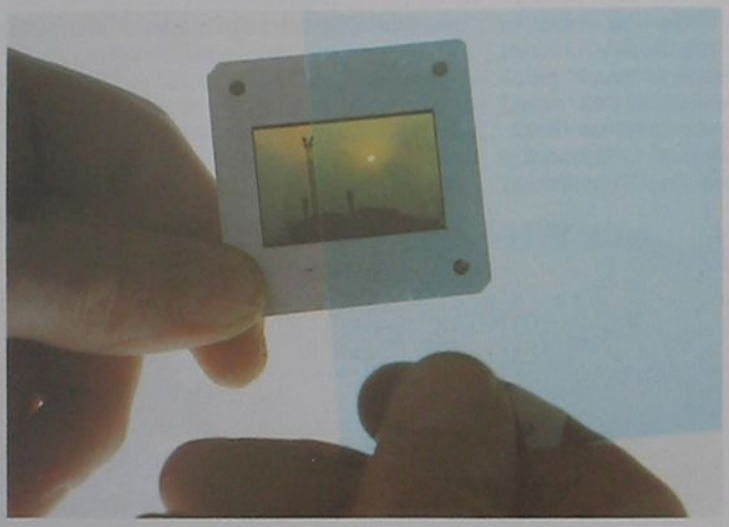
When retouching small format films the dye will generally have to be used on the emulsion or on a separate overlay. To add fine detail it is best to use strong concentrations of dye, working on the dry slide with a good quality sable brush. A jeweller's eyeglass or a hand lens makes this much easier. To reduce any 'teardrop' water marks on the treated areas wipe the slide with pure alcohol before the dye dries.

If you need to cover a larger area of the slide with an even layer of colour it is essential to prewet the emulsion with a dilute solution of wetting agent. This helps the emulsion take up the dye evenly and avoids blotches or streaks.

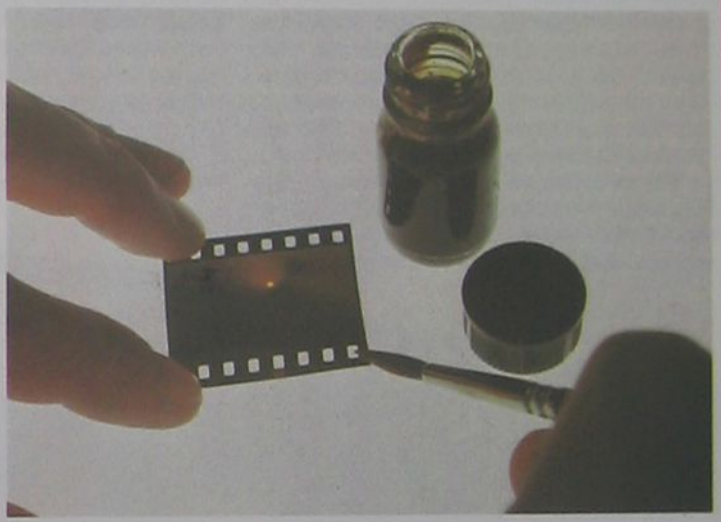
Even these purpose-made retouching dyes may cause some fading or shift in colour balance with time. As with bleaching, it is advisable either to make a good quality duplicate of the retouched slide or to copy and retouch the original.

If too much dye has been added it may be possible to reduce it by washing, either locally with a wet piece of cotton wool or overall by immersing the slide in gently running water. Give the slide a final rinse in dilute wetting agent before drying.

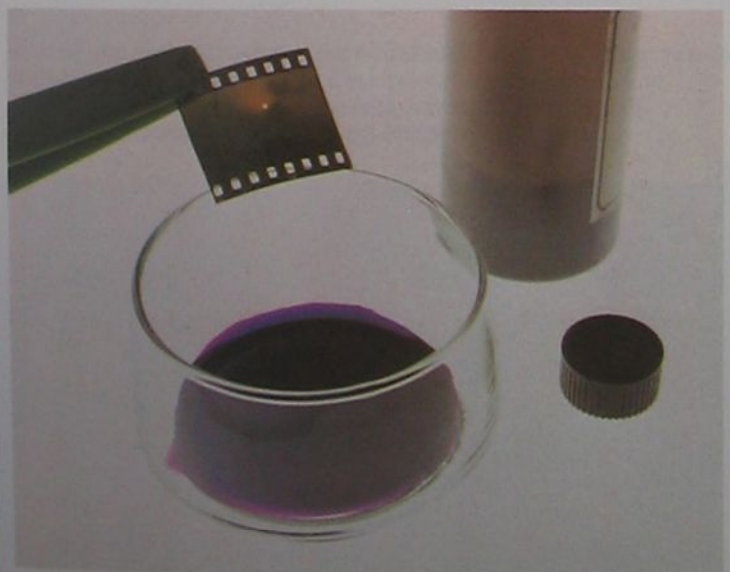
General retouching techniques



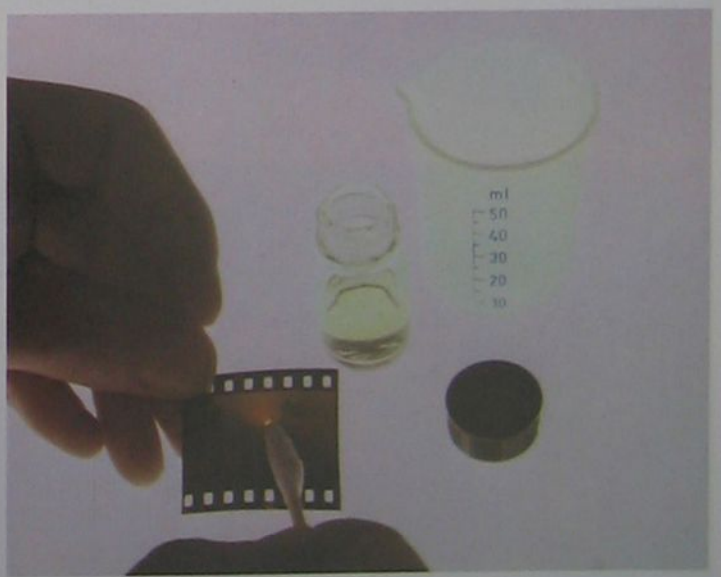
You can add colour to any slide simply by sandwiching it with coloured gelatin or film. Coloured gels are also useful for gauging which of three colours should be reduced



If you intend to reduce or dye only portions of the image, it is best to mask off the remaining areas using special masking material. This can be applied by brush



Use tweezers to agitate the slide in small quantities of dye or reducer. This requires some care so practise on spare slides. Follow the maker's recommendations very closely



The masking material can be removed using acetone (nail varnish remover) or other solvent. Masking material and solvent are included in some kits

Robinson/Brown

Panoramas

A single picture rarely does juctice to an impressive landscape, so why not shoot several, and join up the prints? The resulting panorama often has twice the impact

If you have ever tried to capture on a photograph the dramatic sweep of a distant landscape, you will know how frustrating it can be. A wide angle lens is most suitable for showing the breadth and scale of the scene, but tends to result in large expanses of foreground and sky. A standard or telephoto lens, however, is better for picking out detail, but only takes in a narrow view.

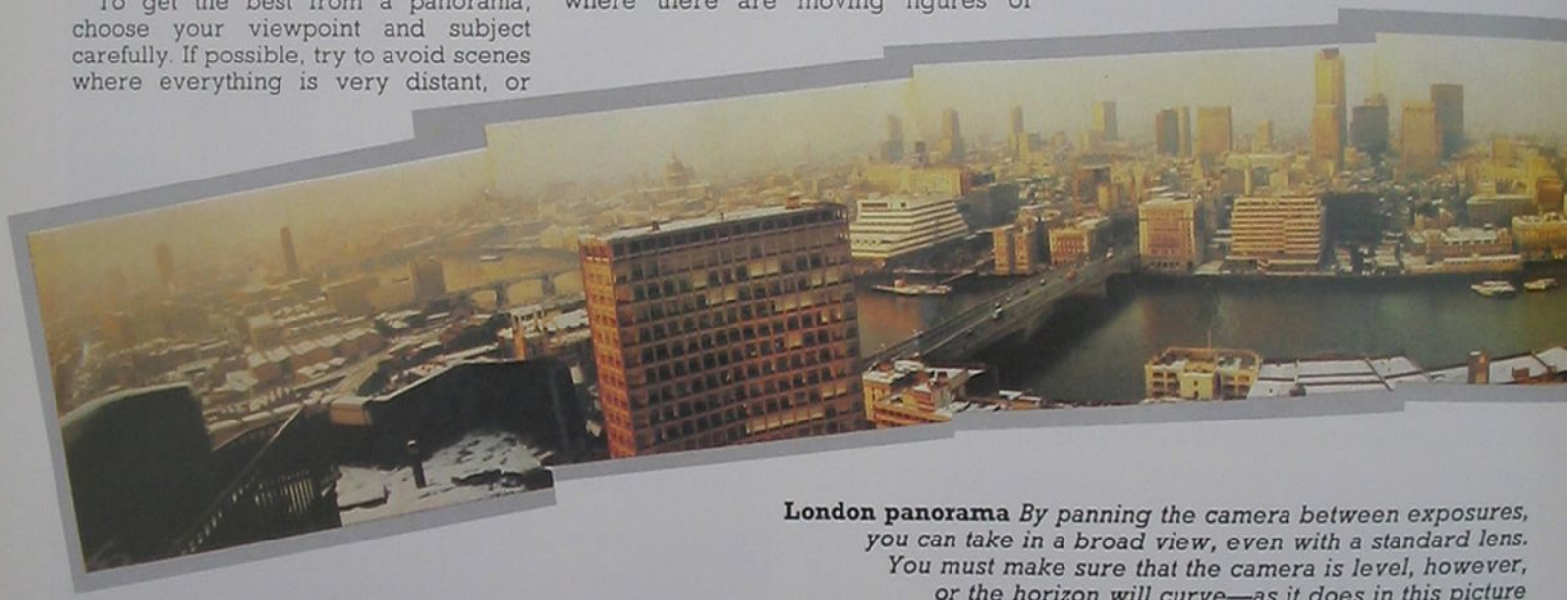
A useful way to get around the dilemma of which lens to use is to shoot a panorama—take a series of photographs from the same viewpoint, but pan the camera a little between each exposure. The prints of these pictures are then joined up to form a continuous strip, so that the entire image conveys something of the grandeur of the view, yet still retains all the interesting detail.

To get the best from a panorama, choose your viewpoint and subject carefully. If possible, try to avoid scenes where everything is very distant, or there will not be any variation in scale in the final picture. A better choice is a scene where the important elements vary in size, or are at a range of distances from the camera, so that they do not appear a uniform scale in the print. Take care, though, that nothing is so big or so close to the camera that it obscures important detail in the distance.

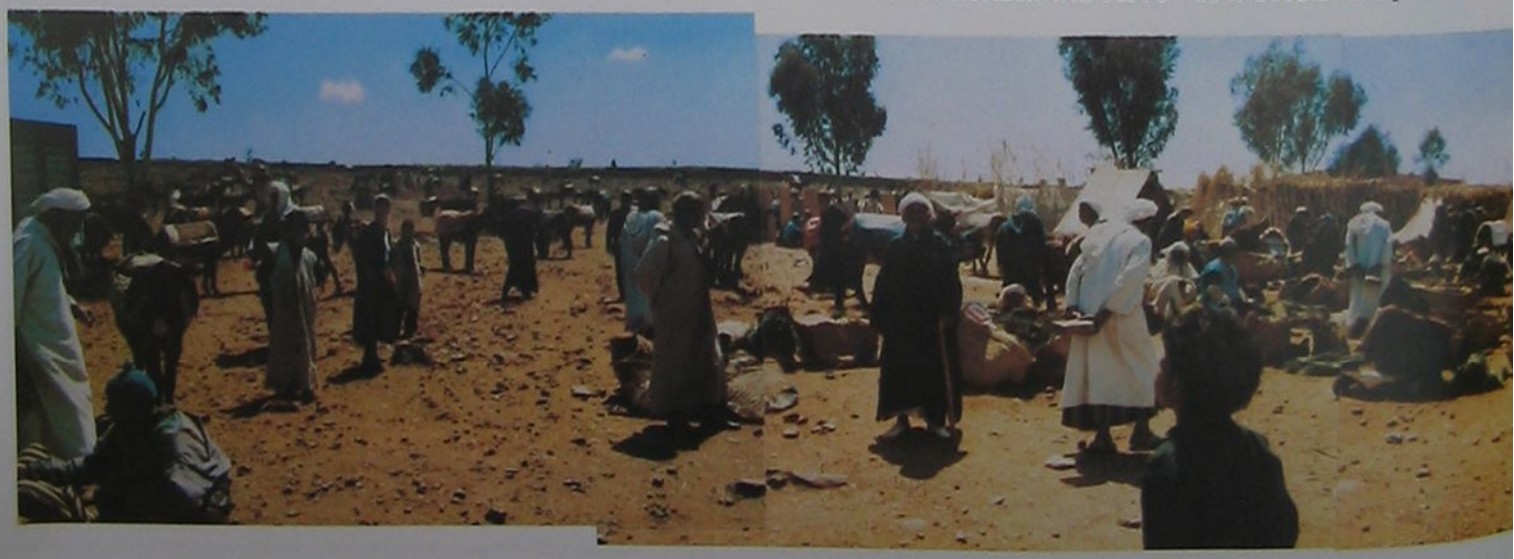
Continuous tone areas are difficult to join successfully, whereas subjects with many clearly defined lines make the process of marrying up the various elements much easier. For this reason, clear blue skies or wide expanses of water are best avoided. A sky broken up by small puffy clouds is much more suitable, as is a landscape crisscrossed by roads, buildings, hedges or walls.

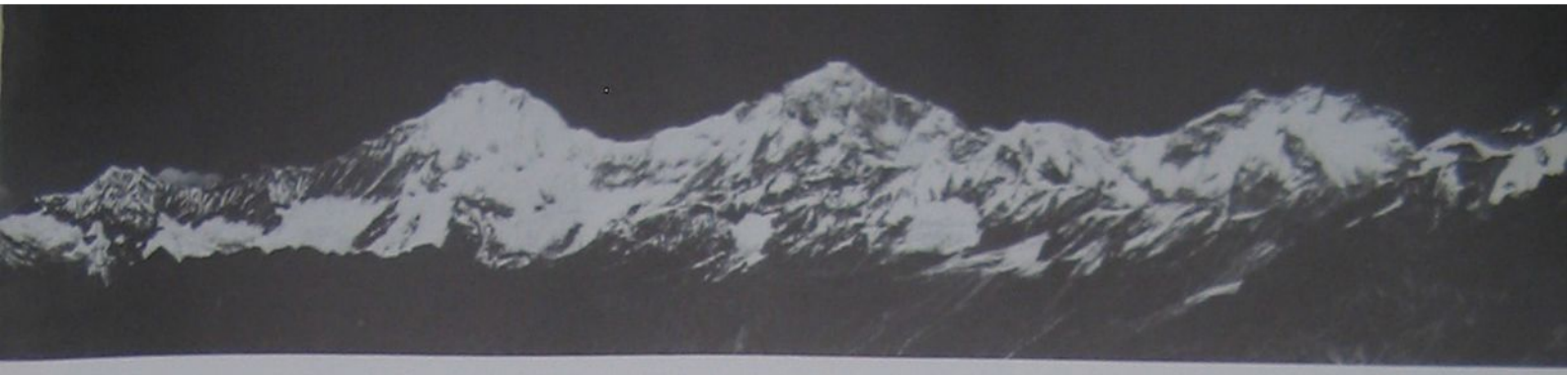
Static subjects are easiest to shoot, but where there are moving figures or vehicles visible, these can actually be used to add interest to the picture, provided that they are fairly central in each of the images that make up the panorama. If there is movement near the edges, there is a danger that there will be difficulties in joining up the final image. Confining movement to the centre of the frame eliminates this.

Once you have chosen your viewpoint, you can begin to set up your tripod and camera in preparation for the pictures. Although hand-held panoramas are possible, a tripod makes life a lot easier. Besides eliminating camera shake, it allows you to use a smaller aperture for better definition and depth of field, and ensures that the horizon remains at the same level within the frame in each consecutive picture.



London panorama *By panning the camera between exposures, you can take in a broad view, even with a standard lens. You must make sure that the camera is level, however, or the horizon will curve—as it does in this picture*





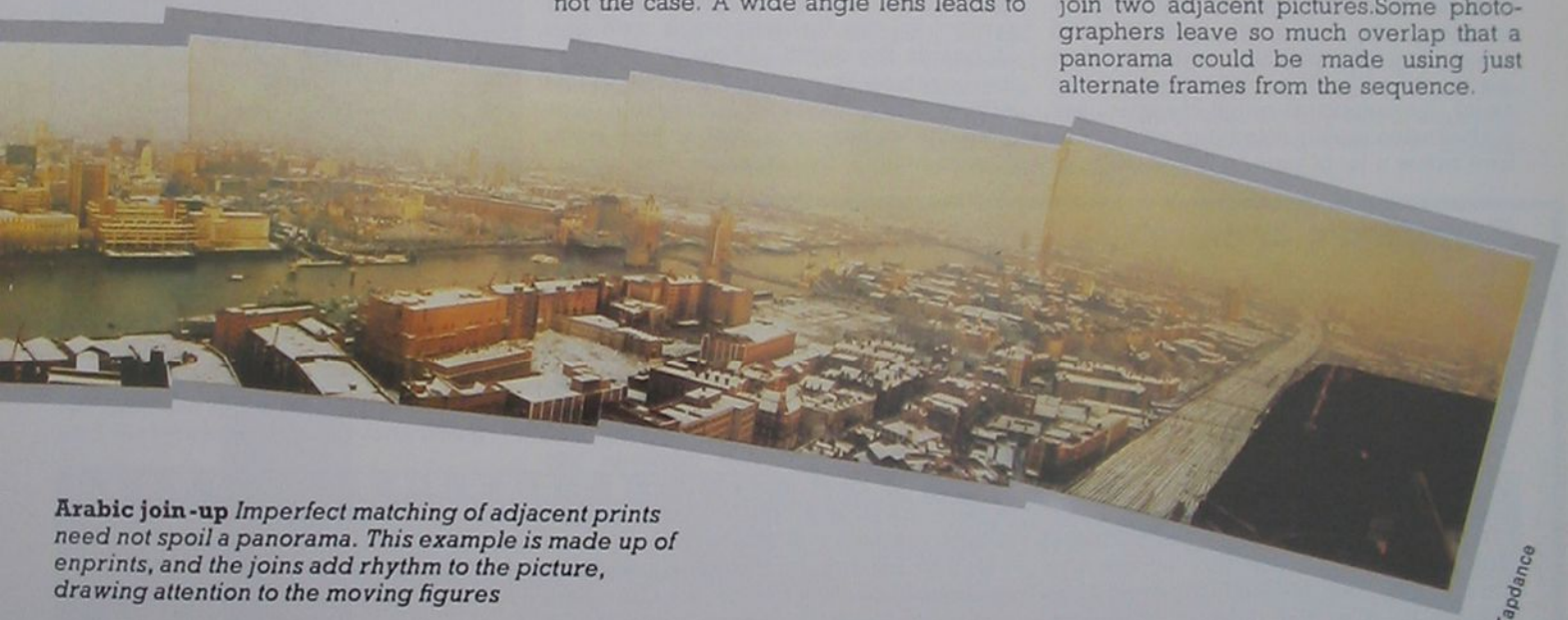
Himalayan mountainscape *If you do not have a wide angle lens, a panoramic picture may be the only way to capture the grandeur of a scene. To conceal the joins in this picture, a red filter was used to turn the sky black*

This last requirement can only be satisfied, however, if the tripod has a pan and tilt head, and is correctly levelled. To level the tripod, set all the adjustments to zero—there is generally a marker on each movement—and place a spirit level on the top plate. Make sure that the bubble tube is at right angles to one of the three legs, then adjust the remaining two legs. When the bubble is central within the tube, turn the level through 90°, and level the bubble again, but this time use only the third leg. If you follow this procedure, you should be able to level the tripod quite quickly, and with the minimum of fuss.

Next attach the camera, and check that as you pan across the scene, the horizon does not appear to move up or down the frame. If it does, it may well be that the tripod head is not manufactured or calibrated with sufficient precision. If this is the case, you must level the tripod by holding the spirit level against the centre column instead of on the camera platform, and use the cross bubble rather than the one that runs the length of the level.

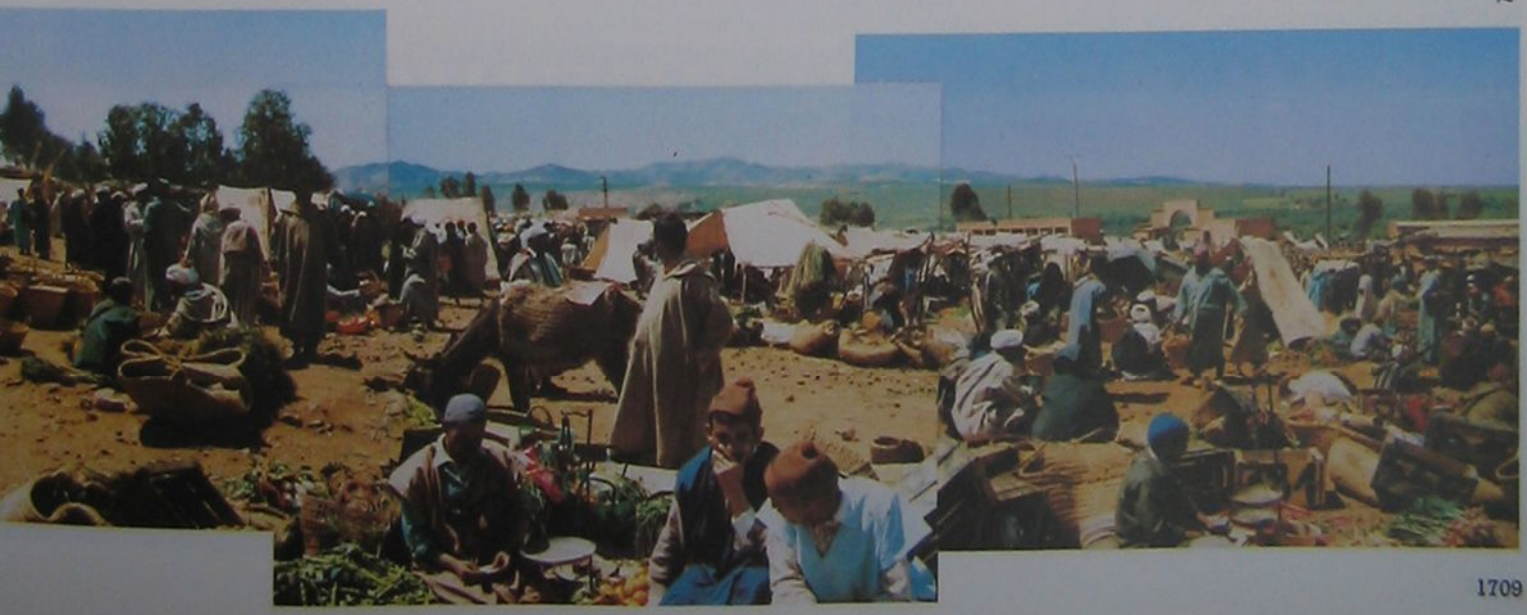
Choosing a lens for a panoramic series is not as simple as it might at first appear. Initially, you might think that a short focal length lens would be the best choice, since it takes in a wide angle of view and therefore reduces the number of exposures needed to make up the panoramic image. Unfortunately, this is not the case. A wide angle lens leads to distortion where the pictures are joined. A standard lens or a short telephoto reduces the distortion to a minimum, but requires a larger number of exposures to be made.

If your subject has few straight lines in it, wide angle distortion might not matter, but generally there is something in the picture that draws attention to the join. For most purposes the practical minimum number of exposures for a 180° panorama is seven, each of which overlap at either side. By shooting pictures with more overlap than this, you increase your chances of finding a convenient line along which to cut and join two adjacent pictures.Some photographers leave so much overlap that a panorama could be made using just alternate frames from the sequence.



Arabic join-up *Imperfect matching of adjacent prints need not spoil a panorama. This example is made up of enprints, and the joins add rhythm to the picture, drawing attention to the moving figures*

Tapdance



Steve Warshall

Exposure and film

Once you have set up the camera and tripod, you have to make a decision about exposure. This is not entirely straightforward because it is likely that a meter reading which is appropriate when the camera is pointing in one direction will be inappropriate when it is turned through 90°, particularly if the sun appears in the scene. The solution to this problem is to select the area of the picture which is of principal interest, and to measure the exposure for this part of the scene. If possible, you should use a hand-held meter in the incident light mode, (see page 541) and under no circumstances should you allow the automatic system of your camera to set the shutter speed or aperture—this would lead to inconsistent exposure from frame to frame, and make printing more difficult. Setting one fixed value for exposure simplifies the printing stage.

The use of negative film also makes printing easier. Transparency film has less latitude to over- or underexposure, and this can lead to burnt-out highlights, or dark, empty shadows. Colour negative film also has the advantage that it can be processed by a standard printing service, to make a quick proof of the panorama.

If you are prepared to sacrifice the colour in the scene (or want to hand colour the picture) then you can use black and white film. Not only does this make the panorama much cheaper, but it eliminates colour matching, and therefore saves a lot of time in the darkroom.

When the time comes to actually make the exposures, work quickly, because the light can change surprisingly fast, particularly in the early morning and late afternoon. If there is a breeze, clouds can move quite quickly, and this can lead later on to some tricky cutting and matching if they travel too far across the frame between exposures.

The time between exposures is greatly increased if you try to bracket them in the normal way. Do this instead by making three consecutive 'sweeps' of the scene —first take a full panorama at the indicated exposure, then a complete one at one stop over, then a third at one stop under.

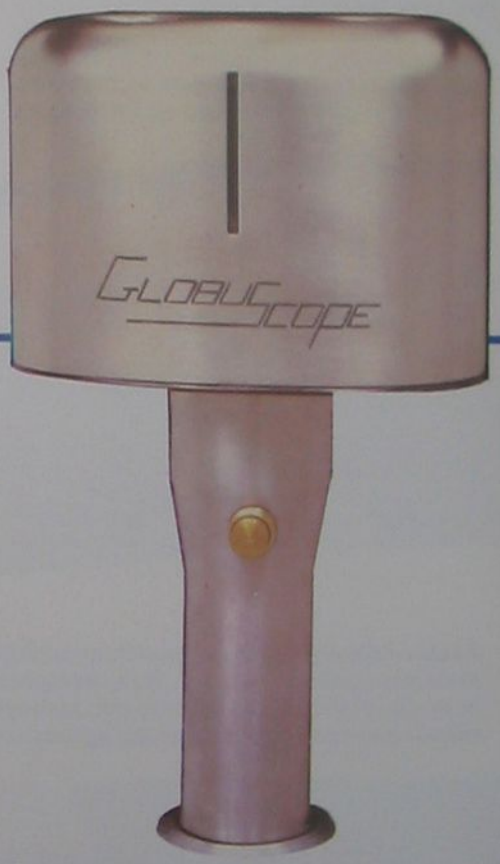
A motor drive or autowinder helps considerably in speeding up the process of shooting the panorama, and if you intend to produce many panoramic photographs, you may want to buy a panoramic tripod head—this has click stops at preset intervals so that you do not need to look through the viewfinder to line up the consecutive pictures.

Focusing the camera for a panorama is simple if the whole of your subject is a long way off. If there are no foreground features at all, focus on infinity. If there are some distant foreground objects, however, set the lens to its hyperfocal distance. Do this by moving the infinity symbol on the focusing scale until it is alongside the depth of field marking for the aperture in use. But if parts of the subject are ranged at different distances from the camera you should take extra pictures, with the lens set at a closer focusing distance. For example, if a telephone box appears a few metres from the camera in one of the pictures, take an extra picture with the box in sharp focus, and then strip it separately into the final print.

Printing and joining

Printing and pasting together a panorama can be an expensive business, particularly if you are working in colour. For your first attempt, then, it is probably a good idea to use standard size prints. These are cheap, and for a trial run, they are ideal—they avoid the relatively tedious job of making eight or nine prints which may possibly prove unsuitable in the end. If your attempt at assembling this panorama is successful, you may then wish to make high quality prints yourself, or have the negatives hand-printed and colour matched by a professional laboratory.

If you are working in black and white and printing the pictures in your own darkroom, you should find it easy to match the density of adjacent prints, so



Panoramic cameras

Even in the early days of photography, panoramic cameras were popular, and there are still a number of them manufactured. Some, such as the Linhof Technorama, have a fixed ultra wide angle lens, and simply use a wider strip of film than usual to produce the panoramic image. Others, such as the Globuscope, form the wide picture by using a rotating camera body and a clockwork drive that moves the film across the focal plane in the course of the exposure. Finally, there is a third type of camera that has a pivoting lens. This moves rapidly through an arc when the shutter release is pressed, to take in a wide angle of view. The Widelux camera is typical of this type.

All these three types of camera differ from each other, and from conventional cameras, mainly in the manner in which film is loaded. The Widelux, for example, has a curved film plane, and the Globuscope has a simple slit instead of a shutter. Both these two cameras use 35 mm film, whereas the Linhof Technorama takes four 180 × 60 mm photographs on each roll of 120 film.

In use, all three types have one thing in common—they must all be held perfectly level if distortion is to be avoided. This makes a tripod essential though any of the three can be hand-held if necessary. The Globuscope, however,

Click-stop head *This special tripod head rotates smoothly, and has click stops which correspond to the angle of view of various lenses. It also incorporates a small spirit level*

Rick O'Shea/Equipment courtesy of Nikon

that there is not an abrupt change at the join. Try and print the images with slightly less contrast than usual, as the contrast inevitably rises when a copy negative is made, which is the next stage.

The procedure for cutting and joining the pictures is described on page 1475. Since skies present special problems when it comes to matching together the individual pictures, you may choose to strip in a separate sky, rather than using the various portions of sky at the top of each picture. Some photographers make a point of photographing particularly attractive skies for this very reason—they accumulate a file of them for future use. If you have a medium format camera, use this for the purpose, because the sky negative needs a greater degree of enlargement than the negatives used for the piecemeal elements of the panorama. A larger format negative minimizes the effects of grain, which always shows up most prominently in areas of even tone.

Do not attempt any retouching on this first copy of the panorama, as the areas most in need of this are likely to be the joins, and the unevenness of the surface at these points makes the task almost impossible. Instead, make a copy print using the procedures outlined on page 944, and retouch this to disguise the joins in the panorama. Retouching techniques are covered on page 766.

If you only want one copy of the panorama, this second generation image may be as far as you want to go, but if you aim to produce many identical prints of it, you will have to make a further copy negative by the same procedure. Since a certain amount of quality is lost each time an image is reproduced, you should use the largest size of film that you can at both copying stages—at least 120 roll film, and preferably 5 × 4 inch sheets.

Though this description will produce a conventional panorama, you can use it as a springboard for more imaginative projects. You might for example, choose to dispense with the tripod, for a free form panorama, or to point the camera steeply upwards so that the horizon curves round into a circle.

Panoramic camera *The quick and easy way to take a panorama is to use a special camera. This one spins round when the button on the handle is pressed, and produces a long thin image on 35 mm film. Minimum coverage is 360°, and the camera will spin until the clockwork motor runs down*

spins through 360° in a little over a second, so that it photographs all its surroundings. This means that unless the photographer is to appear in the picture, he or she must hold the camera overhead, at arm's length.

In practical terms, a special camera is a much easier, quicker and more efficient way of producing a panorama than the more pedestrian cut-and-paste approach. The major drawback is expense—the Linhof costs about four times as much as a professional quality 35 mm SLR. Consequently, many users, even professionals, prefer to hire such cameras rather than buy them.

Globus Brothers Studios

Adam Woolfitt, Susan Griggs Agency

World of photography

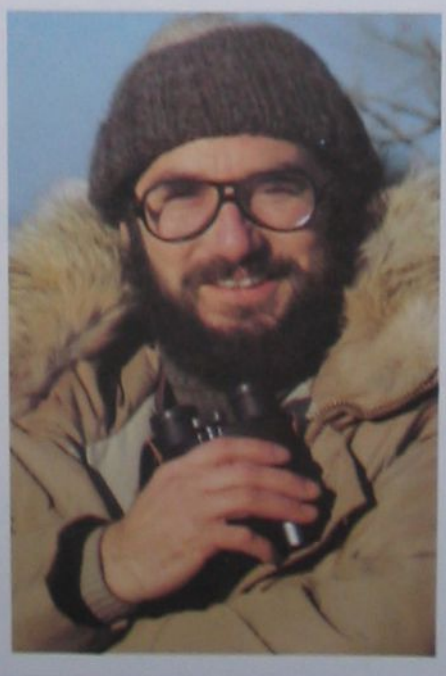
Adam Woolfitt

A master of light and composition, Adam Woolfitt has received international recognition for his evocative landscapes and his powerful images of peoples and places

Adam Woolfitt takes the kind of photographs that every amateur takes once in a while; the difference is that Adam Woolfitt takes them all the time, and, although he is hardly a household name, the chances are that you will almost certainly have seen some of his superb landscapes or his evocative pictures of people and places all over the world.

It is his flair for finding the best light and his almost instinctive feel for composition, that make him so sought after by major magazines such as *National Geographic*, advertising agencies, publishing houses and tourist boards. In pursuit of numerous assignments for such clients, Adam Woolfitt has travelled extensively to places as far apart as the jungles of South America, the isolated Faeroes in the North Atlantic and the deserts of New Mexico.

Woolfitt's own definition of his role is that he is 'a photojournalist with strong landscape attachments.' He is an extraordinarily prolific photographer. He has pictures from every part of the globe and on an enormous range of subjects. But he does very few projects for himself. He takes practically all of his pictures on assignment. 'I'm not the kind of photographer who has a camera under my jacket at parties. When I'm not on assignment I put my cameras away.'

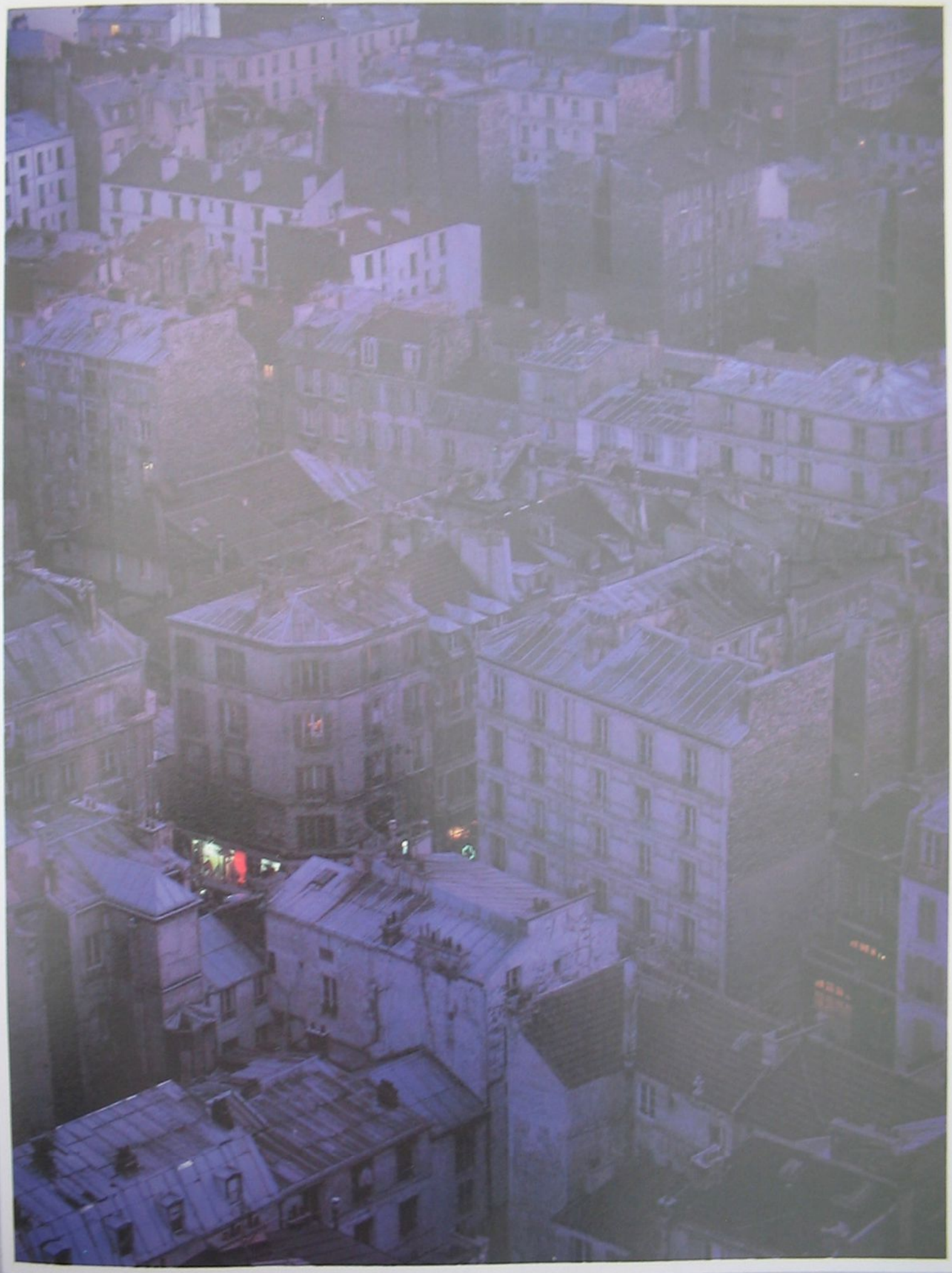


James P. Blair

Clever framing *Creative use of light and shade makes a pattern of stripes out of a zebra at the zoo*

Colour contrast *Lights from shop windows provide a focal point in this study of the rooftops of Paris at dusk* **Adam Woolfitt** *(left)*

Woolfitt followed a fairly traditional route into a photographic career—one that he would recommend to others. In 1956, he went to Guildford Art College, along with budding photographers like Jane Bown, Tessa Traeger and John Hedgecoe. He is a firm believer in the college system, where students begin their training in a studio with a still life and very basic lighting, and then work their way up, processing and assessing each piece of film as they shoot it. 'I



Adam Woolfitt/Susan Griggs Agency

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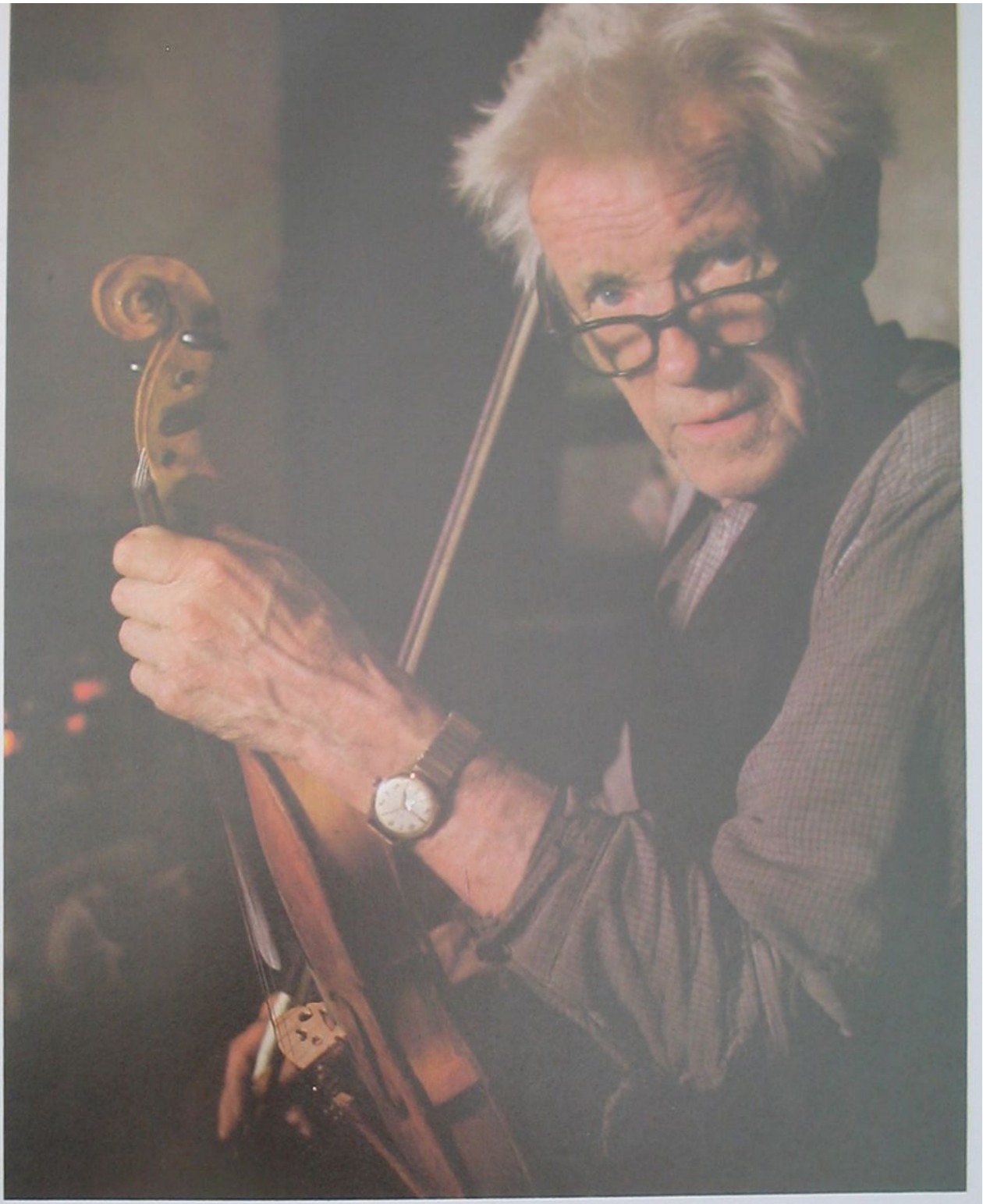
would still recommend this to anybody, as it is immediate. It teaches you about darkroom technique and lighting. It also teaches you basic optics—I'm sure there are some professional photographers going around now who have never looked at the back of a large format and discovered the upside-down image.'

After leaving college at the age of 19, he worked in London 'as a teaboy' at a magazine called *Photography*. He worked in the darkroom and photographed equipment that was going on to the review pages. An incidental benefit of the job was that the magazine sponsored and toured the first major exhibition of Henri Cartier-Bresson's work to be seen in Britain. It was Woolfitt's job to be custodian of the exhibition.

'I looked after it and travelled with it; took the money, locked up, sold catalogues and so on. It went to various galleries, civic halls. It meant that I was exposed to about 120 of Cartier-Bresson's pictures for two very important months of my life—he was the very best of his generation of photojournalists and influenced me enormously.'

Woolfitt moved to Decca Records in 1959 to set up their first photographic unit, entirely devoted to producing PR

Adam Woolfitt/Susan Griggs Agency



Adam Woolfitt/Susan Griggs Agency

Craftsman *Jerry Martin has been hand making violins for over 50 years in Shannon, Ireland*

Welsh estuary *Woolfitt waited until sunlight lit the fields to take this landscape*

End of the hunt *Bloody water from the Faeroe whale kill is illuminated by the evening sun*

material and shots for record sleeves: 'At that time, black and white pictures of stars were handed out in vast quantities. The people at Decca were impressed with my photographs but certainly not with my ability to run a darkroom. I made most of my mistakes in the darkroom—errors of taste, errors of judgement, technical errors: the kinds of things that did not matter at college but when I had ten minutes in which to photograph a band leader, it mattered a lot. In the end, I left'.

Fortunately, a neighbour of mine was then working as a photographer's agent and he had said to me earlier, 'If you ever want an agent, I'd be delighted to do it for you'. So I signed off at Decca at 5.30 on the Friday evening and by 6.30 I was knocking on his door saying 'I'm a freelance'. The next three or four years (1961–64) were very tough indeed. I really had no experience to sell and I had to take anything offered. I once had a job with a small firm in Edinburgh which ran an advertising campaign every Christmas in various magazines. Their adverts had the most appalling format—a single column which ran top to bottom on the left of the magazine page. I'd be given, say, a silver teapot and told to fit that in this long, narrow space—it always seemed impossible but the experience was invaluable.'

During this period Woolfitt was prepared to undertake any work, no matter how difficult. A striking characteristic of his attitude to photography, both then and now, is his ability to see the positive side of even the most problematical

situations. To Woolfitt, problems are both a challenge and a way of exploring his own potential.

Woolfitt had always wanted to be a photojournalist and he regarded every photographic commission, however small, as a step along that route. In 1962 he felt sufficiently confident to do an uncommissioned picture story about a small area in Cornwall and its inhabitants that he knew very well.

Shortly after finishing the story, he had the good fortune to be introduced through family connections, to the famous photojournalist Eve Arnold. As he says, 'I met her at exactly the right point in my career—I personally thought that I had the experience and possibly the talent to be a photojournalist but I needed objective confirmation of the fact. I showed Eve the whole of the Cornwall shoot. She looked at it very carefully and very attentively for over an hour and talked at length about what had worked and what hadn't and why. She was very positive. That meeting was a milestone in my photographic life.'

Woolfitt's career as a photojournalist really began in the mid 1960s with the launching of the *Sunday Times* and *Telegraph* colour supplements in Britain. He took his portfolio along to these magazines and soon began working for both. He has continued to do assignments for them ever since.

It was through the picture desk at the *Telegraph* magazine that he met the editors from *National Geographic* magazine who had come over from America to cover Churchill's funeral in 1966. Woolfitt was unavailable to take pictures of the funeral for them but they remembered his work and invited him to work for them soon afterwards.

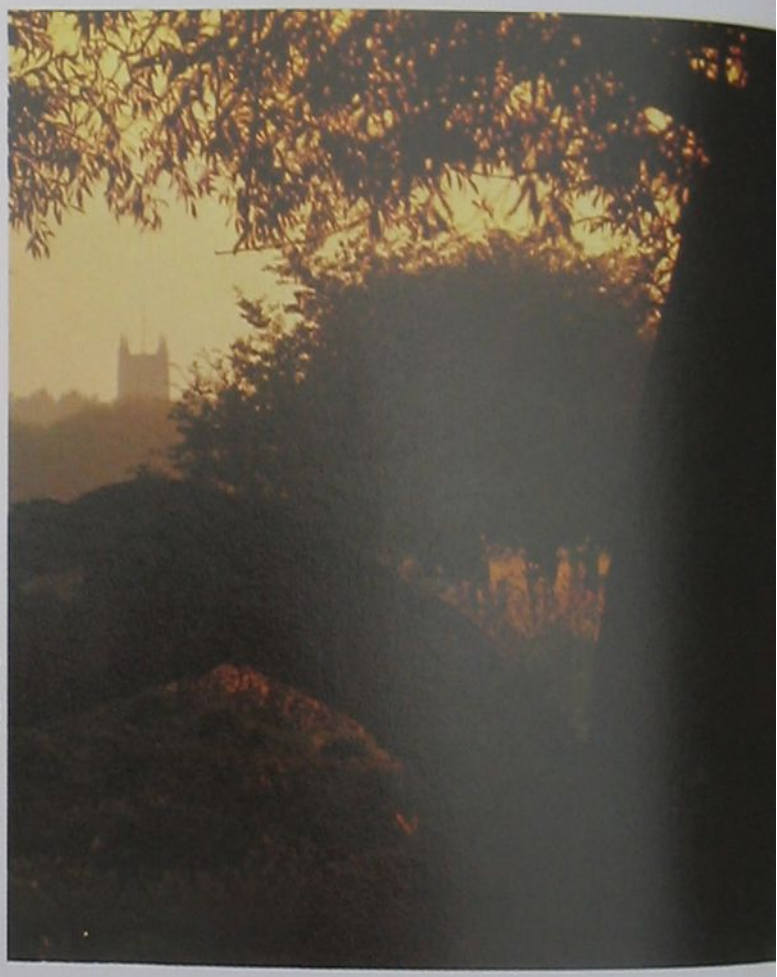
'I've done at least one story every year for them since. They are now the main people I work for in the sense that probably the most important material I've ever shot has been for them, simply because their stories are larger and more extravagant than anyone else's. There is no other magazine that can afford to send a photographer on assignment to a location, for three months or more. They are a reference work and try to be encyclopaedic in what they include in a story. But they give you complete creative freedom providing it suits their particular market.'

One of his most memorable assignments for *National Geographic* was in 1968, when he went for five months to do a story on the remote Faeroe Islands hundreds of kilometres out in the North Atlantic between Iceland and Finland. Undoubtedly, the highspot of his long stay was the whale hunt.

The Faeroese hunt a particular kind of whale—a bottlenosed whale, similar to a dolphin—and this hunt takes place whenever a school of whales is sighted.

'I'd been waiting for this to happen for three months—it was one of the things that I knew I had to shoot as it was a vital part of island life. It had happened once or twice when I was there but generally near an island that I couldn't get to in time, as the hunt could be over in four or five hours. Eventually, events coincided perfectly and I could get to one of the hunts.

'The light was extraordinary, the setting was perfect. I'd photographed from every conceivable position—on the boats, on the shore—I shot 22 rolls of film in two hours. They are among the most exciting pictures I've ever taken.' These pictures won Woolfitt the 1970 Rank Press Pictures of the Year Award.



Eerie landscape
The chance appearance of a rainbow gives an unearthly air to the white domes of an oil refinery in New Mexico

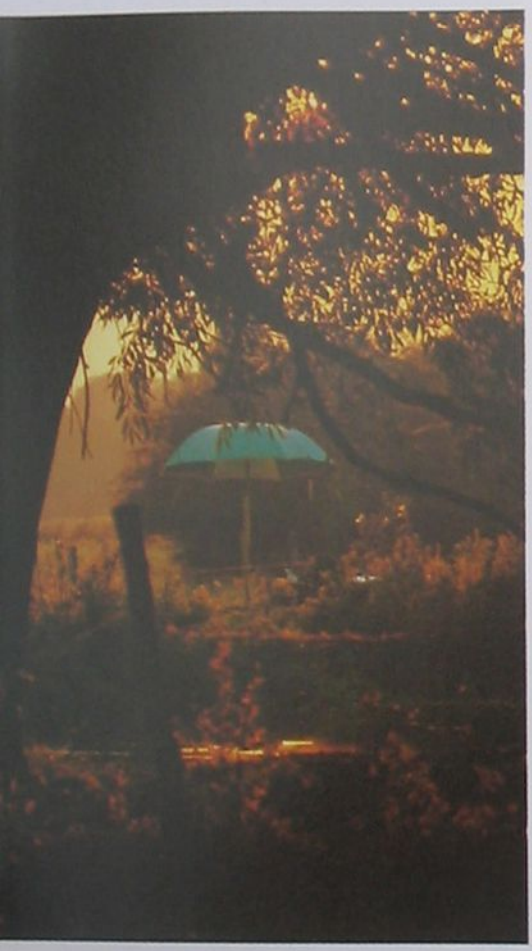
Splash of colour
The golden light and the dominant form of the foreground tree enhances the fragile image of the umbrella in the background

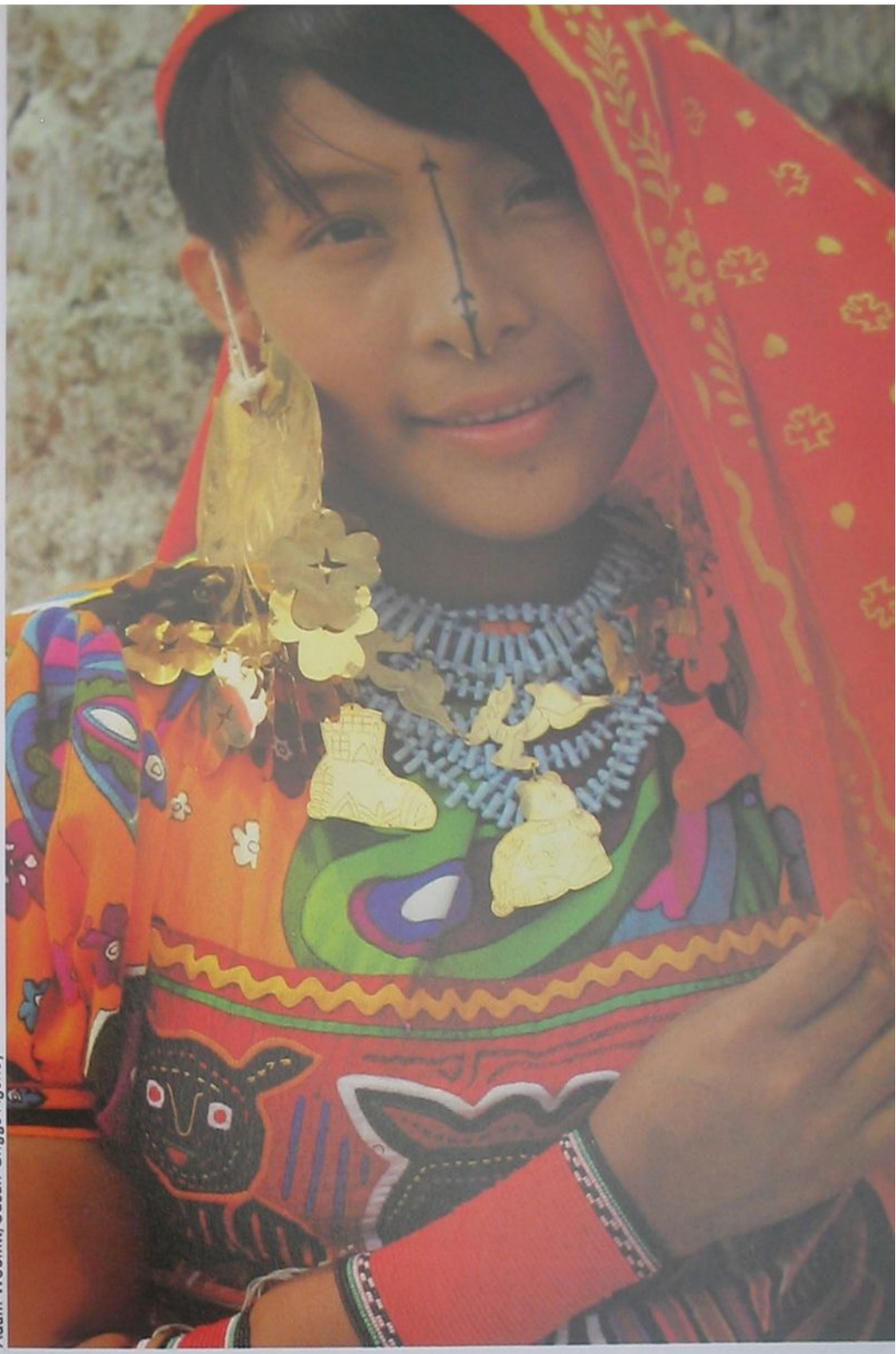
Indian girl
An assignment for 'National Geographic' resulted in this portrait of a Cuna Indian in traditional dress

Adam Woolfitt/Susan Griggs Agency

Another assignment that has given Woolfitt great satisfaction in recent years is another picture story about Cornwall. 'It's very much like a grown up version of the pictures I showed Eve Arnold all those years ago. I knew almost every picture I wanted to make before I started and it was just a question of choosing the right time to go and shoot them to perfection. The pictures I made are as good a record of Cornwall as I shall ever make.'

Woolfitt uses an enormous amount of equipment and admits to having something of an obsession about it. He uses a vast range of lenses, from a 17 mm to a 400 mm. Within that range, he most frequently uses the 80–200 mm zoom, but his favourite lens is the 24 mm wide angle. He uses Nikon cameras and owns





Adam Woolfitt/Susan Griggs Agency

an F2, FE and two F3s. Many of his pictures rely on subtle lighting effects and rich colouring, so he uses Kodachrome film whenever possible.

Woolfitt talks at length about the importance of looking closely at everything whenever he is on an assignment. He draws strong parallels between the art of painting and that of photography. Careful composition is of prime importance to each discipline. He believes that good pictures do not just appear; they are arrived at through painstaking care. So, in photography, he 'sketches' with his camera, testing the variables. Many shots are rejected in the pursuit of perfect framing. For him, photography is as much of a craft as painting.

This patience and care is also reflected in his attitude to light. He will spend hours waiting for the ideal light, particularly in landscape photography. 'Photographers "draw" with light. The perfect use of light makes the difference between a dull and a special picture.

In addition to all his other work, Woolfitt does general advertising work. 'I like working within the restrictions of an advertising brief—it's good to work to a discipline, doing something that has been precisely described to you. It is interesting, and it is financially rewarding. However, the sad fact is that if you work 365 days a year for the best magazines, you would still not make as much money as working say a month with the best advertising accounts.'

On a practical level, most of Woolfitt's income comes from published stories and pictures sold to magazines. *National Geographic*, for example, hold the rights only to the material they publish. The rest is returned to Woolfitt. This and other material is then handled by a London picture agency. In a good year up to 50 per cent of his income can come from the sale of stock shots.

It is a source of pleasure to Woolfitt that shots that might have been rejected for an assignment can be used in a different context. He likes to follow his work through to the publication stage, which he regards as just as important a part of his work as the actual picture taking. 'A story isn't finished for me until the shots finally appear on the printed page.'

Colour analyzers

A colour analyzer gauges the filtration required for printing a colour negative or transparency, and helps you to make quick, well-balanced prints

***Integrating analyzer** This compact model clamps to the enlarger along with the enlarging lens. A diffuser, positioned under the lens, thoroughly scrambles the colours of the negative or transparency and gives an average, integrated, reading. The 'channel'—yellow, magenta or cyan—is first set on the horizontal knurled ring (below left), and filtration for that colour adjusted on the colour head dial until the light emitting diodes on the front indicate that the filter value is correct. The small dial on the right is used to adjust the sensitivity of the analyzer to light of any colour. The whole unit swings out of the way (right) ready for printing*

The simplest way of determining filtration and exposure in colour printing is to make a test strip. Although this is reliable, it is slow and can use up stocks of expensive colour paper. By using a *colour analyzer* you can speed up the process, increase accuracy and cut paper wastage to a minimum.

As its name suggests, a colour analyzer analyzes the colours which make up a negative or transparency, and gives a set of filter values for a balanced print. It does this by electronically comparing the colour densities of the negative with those of a standard reference negative, which have been *programmed* into it beforehand.

Analyzers have a 'channel' for each emulsion layer of the negative—red, green and blue—plus one for exposure, which measures white light. On some analyzers the latter is combined with the red channel, because cyan filtration is rarely required in negative printing. You adjust filtration by fitting the analyzer to the enlarger, switching it to each channel in turn, and setting the filter values it indicates.

Most colour analyzers are easiest to use with a colour head—you place the analyzer under the enlarger, and it indicates whether filtration is correct or not. For use with an enlarger which has a filter drawer, some analyzers have a *calibrated meter*, which gives filter values in units. This saves you trying one filter combination after another until you find the right one.

Two types of colour analyzer are available—one gives an integrated reading, the other a spot reading. These work on the same principle as spot and average exposure meters. Both do the same job, but each of the types have advantages and disadvantages both of a technical and practical nature.

Integrating analyzers

An integrating analyzer reads off the whole area of the negative, 'scrambling' all the tones and colours it sees. As with an average exposure meter reading, the principle is that in the majority of photographs the resulting reading is an average for the general scene in view—usually a neutral mid grey. This system works perfectly well in most cases.

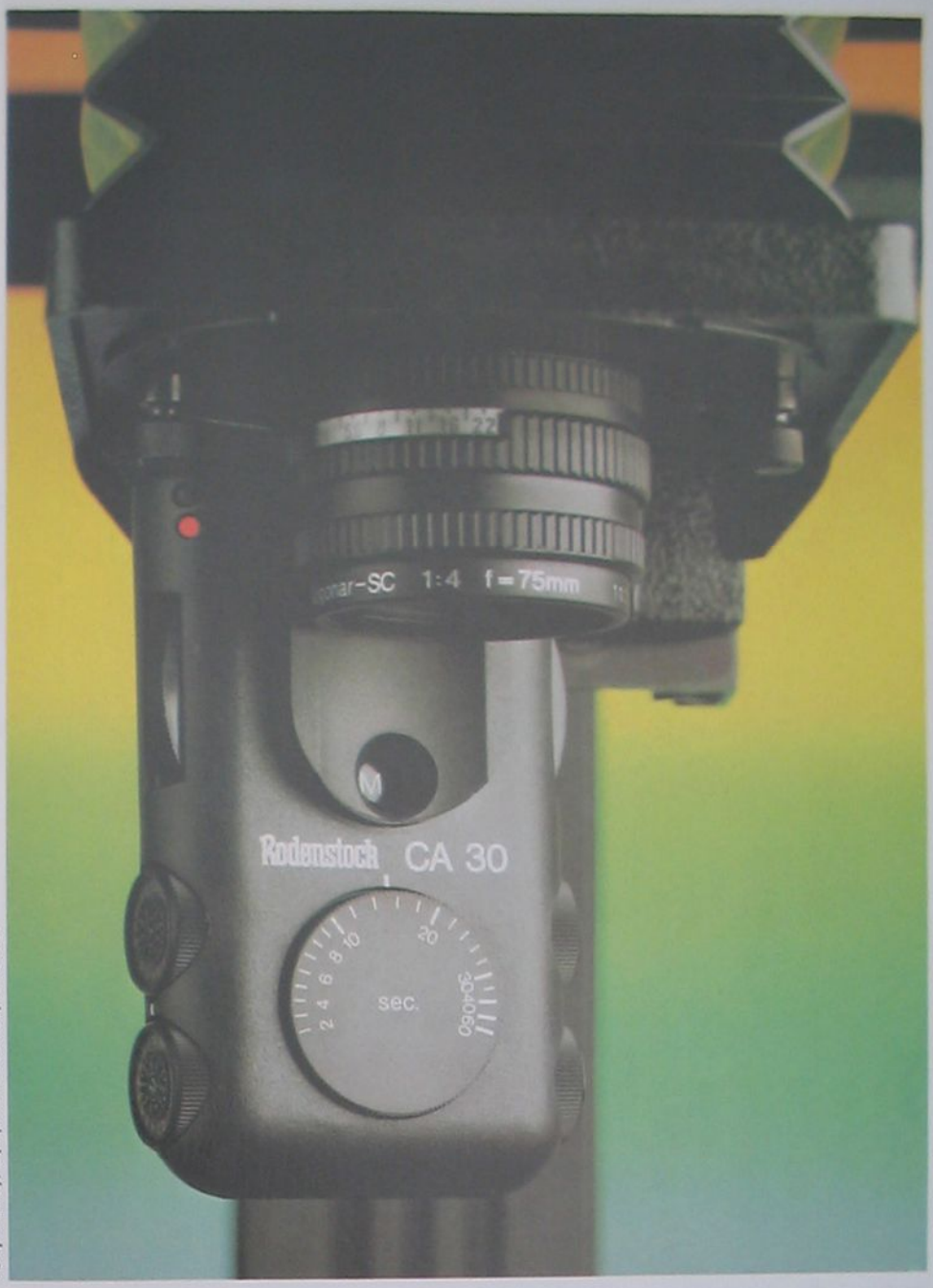
The disadvantage of this type is that when the negative is not an average one results will be slightly unbalanced. For instance, for a predominantly blue subject the analyzer will indicate filtration which produces a slightly yellow cast. Similarly, with a 'thin' negative the exposure indicated will be rather short, resulting in a light print. With experience however, it is possible to compensate for these factors where necessary.

Some analyzers consist of a diffuser, fitted under the enlarger lens, and a

Integrating probe analyzer *This model has a unique method of measuring light —used in conjunction with a special lens, its probe is inserted into a space between the elements, and takes an integrated reading*

Grey scale *If you use a spot analyzer, you should ideally include a grey scale when shooting your picture (below right). This provides a standard reference on which the analyzer can base its reading to give filter values for colour balance. The scale can then be cropped out in printing. This poses problems in practice however, but you can take a reading off a flesh tone instead of a grey scale, for acceptable results*

Tony Hurley/Equipment courtesy of Durst

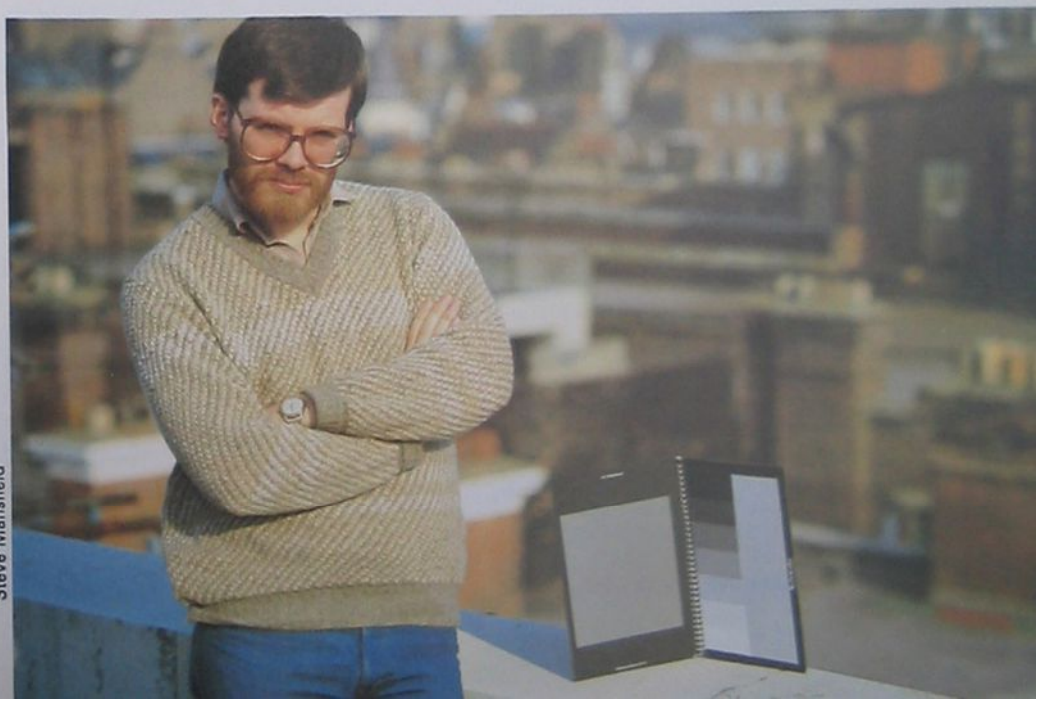


Tony Hurley/Equipment courtesy of De Vere

probe which is placed on the enlarger baseboard. Others fit directly on to the enlarger lens—the Rodenstock, for example, actually slots between the elements of the enlarger lens of the same make. Some lens-mounted models fit any enlarging lens currently available.

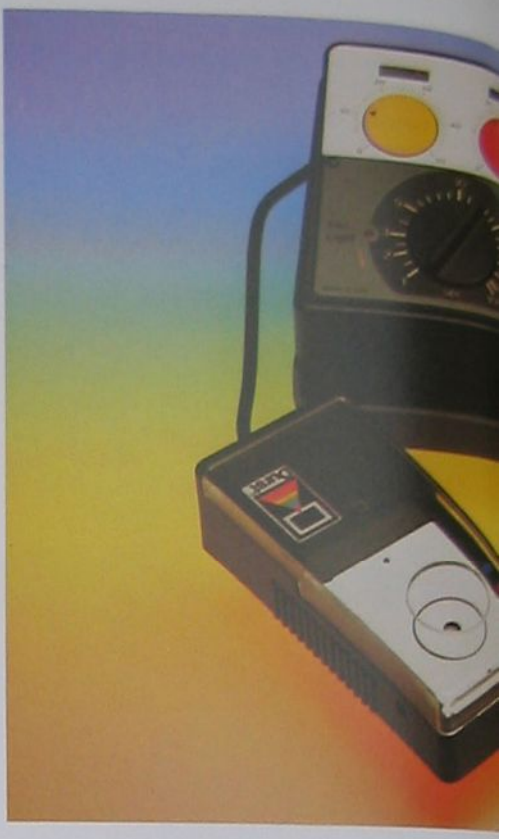
Lens-mounted analyzers offer the advantage that they can be used in normal room lighting, while probe-types cannot. To measure the exposure, the analyzer must be removed from the enlarger lens and used in the same way as an enlarging meter (see pages 1136 to 1139).

Some of these analyzers do not give a reading in units, but simply show by means of light-emitting diodes whether settings should be reduced or increased. Others have meters which are calibrated in colour filter units. One model has a built in timer, which automatically gives the right exposure once set.



Steve Mansfield

Equipment courtesy of Melico

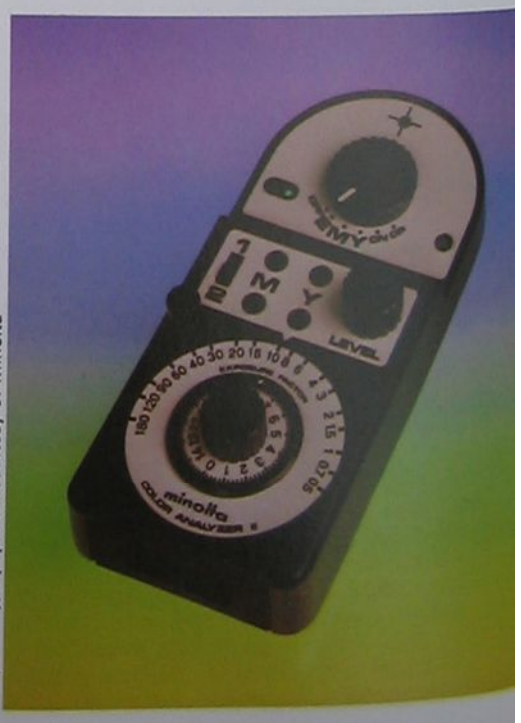


Equipment courtesy of Durst

Durst CM300 *This spot analyzer includes a timer and a set of cards which are placed over the controls once the unit is programmed—the settings can then be written on the cards, which act as a set of 'programs' for future reference*

Melico Cadet *The four separate controls for white, yellow, magenta and cyan light are extremely sensitive, allowing very fine programming adjustments. The analyzer is internally stabilized against mains voltage fluctuations*

Minolta analyzer *The advantage of this compact unit is that it can be used on the enlarger baseboard to take spot readings from a small area of the image*



Tony Hurley/Equipment courtesy of Minolta

Since different makes of paper have slightly different colour balance, if you change your make of paper, filtration must be changed to achieve the same effect. Some analyzers have more than one program channel, so that at the touch of a switch you can change from one paper to another and still get consistent results. The different channels can be programmed for any set of conditions, so you could, for example, change from colour negative printing to printing transparencies.

Spot analyzers

Integrating analyzers usually give correct exposure and colour balance—a spot analyzer, however, can give you correct exposure consistently, even from a non-average negative or transparency. They do need more care in use, though, in the same way as a spot exposure meter. For successful results, you must choose the grey area of the negative to take your reading, or exposure and colour balance will not be correct (see page 1554).

Spot analyzers are more advanced and complex than integrating models. One model which is available has a device which compensates for reciprocity failure, which can influence print colour with different exposure times. Another even more advanced type has a fibre optic probe, and modules which plug into it to give different programs. A third type has a facility for compensating for light fall-off when the reading is taken at the edge of the picture area.

These analyzers are extremely useful when the nature of the negative or transparency is such that compensation with an integrating analyzer would be difficult. Any spot reading analyzer can be used as an integrating analyzer if a suitable diffuser is fitted over the lens.

Choosing an analyzer

For general use, especially if most of your pictures are of average density, an integrating model should be quite adequate. It is simple to use, gives good results in the great majority of cases, and will cost less than a spot type. You should be able to buy one for roughly the same price as an inexpensive to medium price SLR.

If you tend to specialize in a particular type of photography, or often take shots with unusual tones or contrast, a spot analyzer should be more suitable for your needs. Although it needs more

Equipment courtesy of Philips

Philips PCA 061 *Incorporating a timer, this spot analyzer differs from most other models in that it has a needle which shows by how much the filtration is over or under the correct value, a system allowing very precise control*

Melico PM4 *features preprogrammed plug-in modules which can be used to adjust the analyzer instantly to a new set of conditions, such as printing from slides. The diffuser converts the unit from spot to integrated readings*

Equipment courtesy of Melico

care in use, it is more versatile—and you can in any case adapt it to take integrated readings. Good quality spot analyzers, however, are considerably more expensive than integrating models, and you should decide whether it is worth your while spending the extra money.

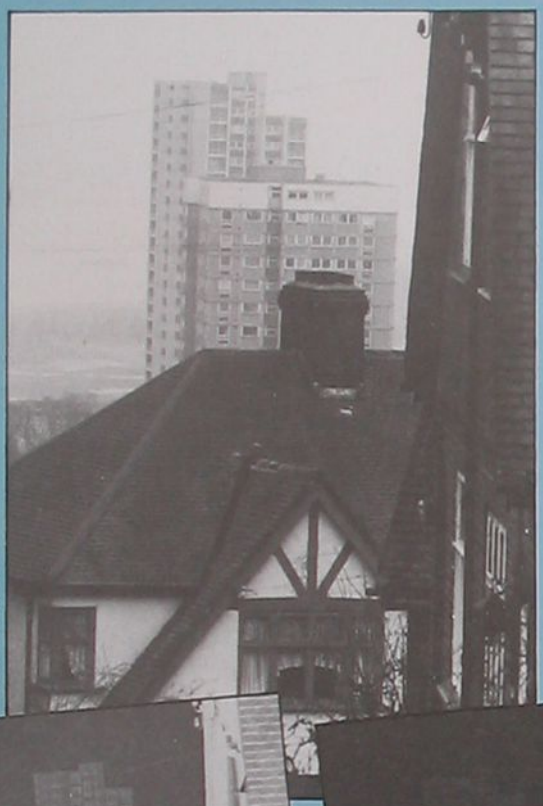
Whichever type of analyzer you buy, it is an advantage to have one with calibrated controls—this makes it easier to set to a different program when you change to a different type of paper, or from negatives to slide printing. Bear in mind, also, the type of enlarger you use —if it has a filter drawer rather than a colour head, a calibrated meter on the analyzer makes it simpler to set the filtration to the correct values.

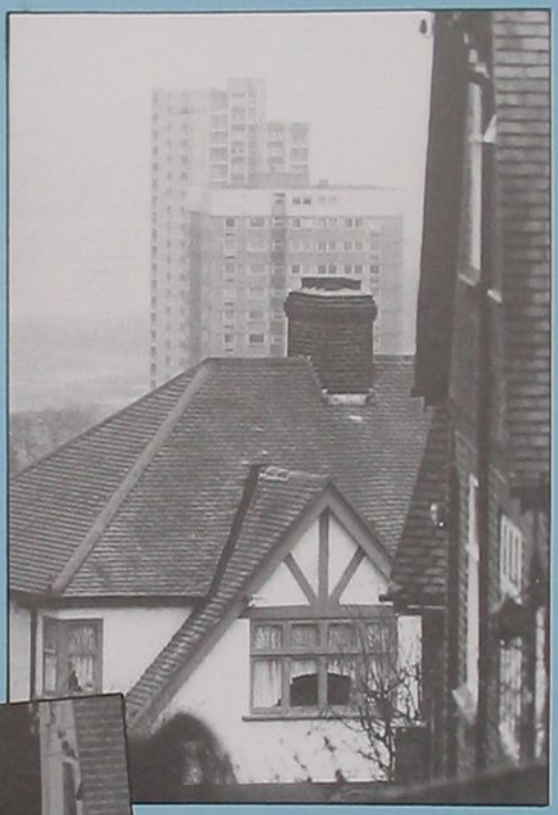
Using a colour analyzer does not mean that you will automatically obtain correct colour balance in every print you make —your results will only be as accurate as the program you put into the analyzer. However, if you follow the manufacturer's instructions scrupulously, it will give your colour prints a new standard of accuracy and consistency. Moreover, since in most cases you do not need to make a test print, the saving in paper is considerable, so your analyzer should quickly pay for itself.

Understanding...

Reducers and intensifiers

A negative which is too dense or too 'thin' is very difficult to print. Fortunately it is sometimes possible to change the density of a negative to give a more acceptable result





David Gordon

Lighter print *One effect of an intensifier is to improve the contrast of a thin negative (near left), but graininess is also increased*

Even with modern equipment and techniques all photographers produce pictures which are badly exposed or processed at some time. Negatives in particular can be too dense or too thin and so require unavailable grades of paper or time-consuming dodging at the printing stage. Fortunately, with black and white negatives it is sometimes possible to treat the negative with a *reducer* or *intensifier* to produce a more printable result.

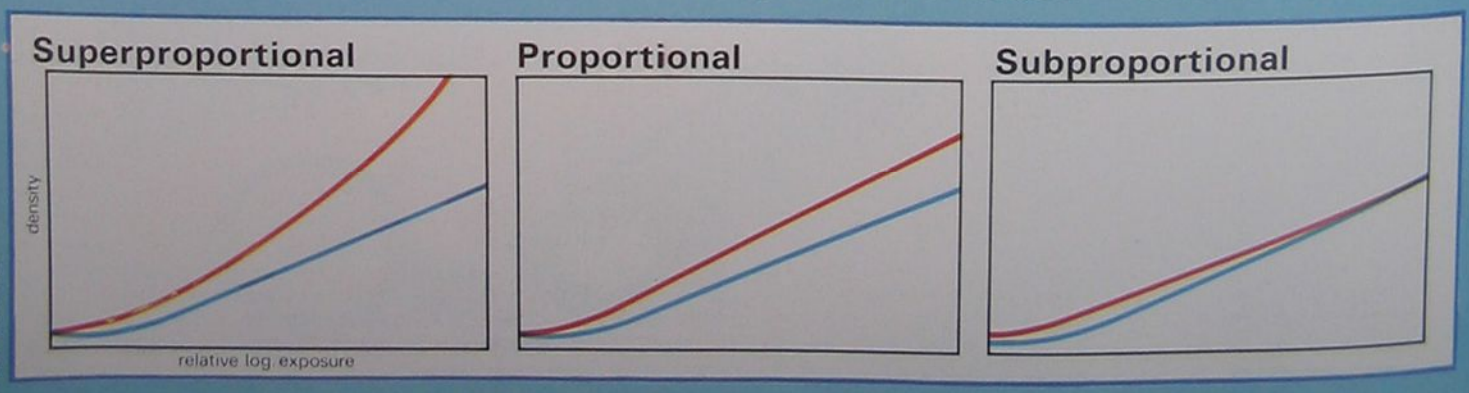
An intensifier is used to increase the density of a negative while a reducer lowers it. But neither material can produce detail which is not present in the original. For example, an underexposed or underdeveloped negative lacks detail in the shadow areas. An intensifier cannot rectify this by providing detail in these areas. Instead it simply reinforces those tones which are already present to give a reasonable density range. So these processes are not alternatives to correct exposure and processing technique.

Reducers

When the negative is too dense a reducer can be used to remove some of the silver which forms the image. This can be done for the whole negative, but in the case of larger formats just parts of the image can be treated. Reducers should not be confused with reducing agents. The latter are responsible for producing silver whereas reducers contain *oxidizing agents* which remove it.

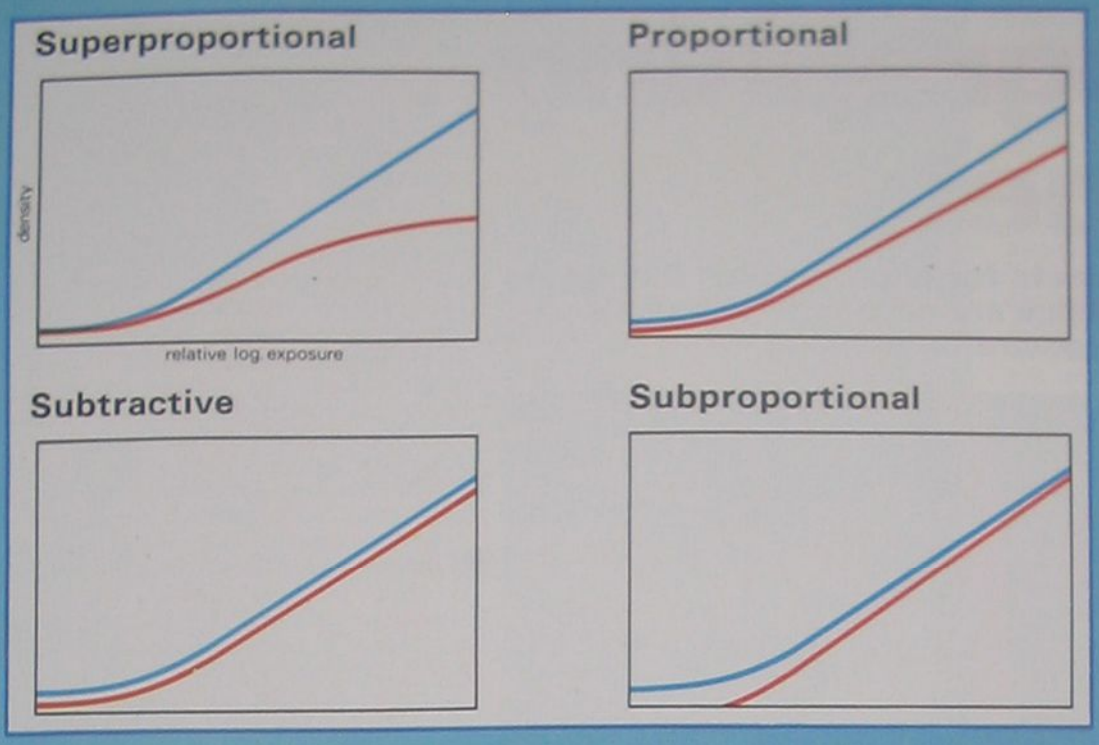
The oxidizing agents are combined with suitable solvents to convert the silver image into soluble silver compounds which can then be removed by washing. The amount of reduction is controlled by how long the negative is treated, but there are other types of control available which depend on the type of reducer used.

The best known type is



Paul Williams

Intensifier types *The increase in density (red line) varies with different tones according to the type of intensifier used*



Paul Williams

Reducer types *The red line shows how densities are reduced, affecting different tones in a variety of ways*

Farmer's reducer which is *subtractive*. This means that equal amounts are removed from all densities so that the negative becomes thinner but the contrast remains unchanged.

The main ingredients of Farmer's reducer are potassium ferricyanide which converts the silver to silver ferrocyanide, and sodium thiosulphate which makes the silver ferrocyanide soluble.

A strong solution of Farmer's reducer gives a *subproportional* solution—one which removes proportionally more from the lower densities than the other tones —which is particularly effective with fine grain emulsions such as line films. This type of reducer is also sometimes used for prints to clean up degraded highlights.

Other types of reducer are *proportional* and *superproportional*. The first removes the same proportion of silver from all areas so that the actual amount removed is greater with high densities than with shadows. The result is a lowering of contrast and this is very useful for overdeveloped negatives. The most common proportional reducer is *acid permanganate* which contains potassium permanganate and sulphuric acid. This converts the silver to silver oxide and then to silver sulphate which can be removed by washing.

Superproportional reducers remove proportionally more silver from higher densities. The result is a lowering of contrast but without removing too much shadow detail. The main ingredients are usually ammonium persulphate and sulphuric acid which act in a similar way to acid permanganate.

Intensifiers

Like reducers, intensifiers are also divided into groups depending on the way they act on the various densities. But in addition there are two ways in which the intensification is achievedj

A *physical* intensifier works in a similar way to a physical developer (see page 1571) in that it deposits silver atoms from the solution on to the silver forming the image. In this way the existing image is increased proportionally to give higher contrast. The result is permanent and gives no colour change.

A *chemical* intensifier works by using an oxidizing agent to convert some of the silver in the image to silver halide which is then reduced to silver in a similar way to normal development. At the same time other metals contained in the intensifiers, such as mercury or chromium, are deposited on the image giving greater density.

Chemical intensification can be done in either of two ways. The first method involves two stages—bleaching and redevelopment—and it is this technique which is used for sulphide (sepia) toners. The second method is to combine the two agents so that intensification occurs in one step.

Some chemical intensifiers can add a great deal of extra density but often involve a change in colour. The brown image which often results makes judgement of printing quality less easy. The keeping qualities of the negative are also reduced with some intensifiers.

Adding more metal to the existing image makes the grain clumps larger. This has the effect of increasing graininess so many intensifiers are not particularly suitable for small formats.

Negatives which lack contrast or which require a high maximum density (such as for line work) can be treated with a superproportional intensifier which greatly increases the difference between tones which are similar in the original.

Proportional intensifiers are useful for giving extra contrast to slightly underdeveloped negatives. A typical example is *chromium* intensifier which contains potassium dichromate and hydrochloric acid in a single solution. This bleaches the image to silver chloride (a halide) plus a chromium compound. The halide is then reduced back to silver in a standard developer but has the addition of chromium to increase density and contrast.

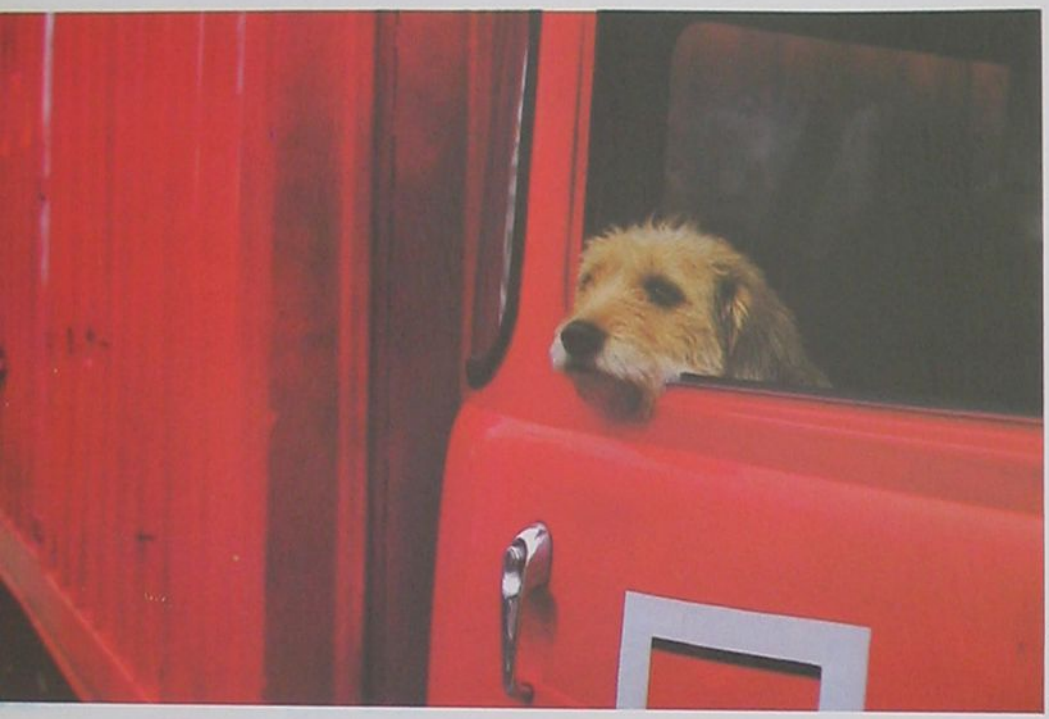
The chromium intensifier can also be used as a subproportional type (giving a greater increase in density with the lower original densities) by employing incomplete bleaching or redevelopment.

David Gordon

Darker print *Dense negatives can be reduced (right) in order to obtain a reasonable maximum black and contrast range in the print*

Photographing pets

Pets are popular subjects for photography, but plenty of time and patience are needed to shoot the most rewarding pictures



Homer Sykes

Photographing pets is broadly similar to photographing babies or young children in that neither subject is likely to keep still or produce the right expression on demand. You must be prepared to be flexible in your approach to pictures of pets, and you may well need far more time and film than you had anticipated. If you rush your photographs, the results will often suffer.

In photographing any creature, it helps considerably if you have some knowledge of its behaviour—where its favourite haunts are, when it is likely to be hungry or sleepy, and whether it will respond to coaxing of some sort. If it is your own pet you will know many of the answers, but if you are photographing someone else's pet, talk to the owner and find out as much as possible about their animal. Spend a little time simply observing the pet, and let it get used to you before you attempt to shoot any pictures at all. At the same time take note of any attractive backgrounds in the house or garden, bearing in mind the animal's particular colour.

Dogs and cats are the most popular type of household pet, but the problems that each presents can be distinctly different. While dogs may be the easiest animals to control, they are not necessarily the easiest to photograph since they tend to get overexcited, particularly when they feel they are the centre of attention. They may then run riot, and your picture session will be quickly curtailed. Generally, it may be a good idea to take a dog for a long walk before attempting to photograph it, to disperse some of its excess energy.

Dogs do respond to a variety of noises with alert expressions, but these may not last very long, and it is worth asking a friend to produce the noises for you, while you concentrate on capturing that interesting expression before the animal loses interest. Coaxing a dog with food is not a good idea, as they do not like being disturbed while eating, and may even occasionally become aggressive.

While a formal portrait study of a dog may be easier to take indoors where the animal can be contained in one place, dogs are certainly at their happiest outdoors, but in this case you must be prepared for more of an action shot and less of a portrait. If the dog is playing outside, it is often a good idea to get down to its level, but watch for the background at the same time. A background of grass and trees will give far better results than a cluttered or simply too colourful flower bed.

Use a fast shutter speed and compose as tightly as you can. Focus on the eyes first of all, as these are usually the centre of interest in the picture. Try and alter the composition to suit the animal. For instance, long nosed dogs tend to look more appealing when photographed in profile or three-quarter view, rather than head-on. When focusing on the eyes, check that there is sufficient depth of field to show the whole head sharply,

George Zimbel/Colorific

especially on long-muzzled dogs.

Outdoors, there is the opportunity for more unusual action shots—perhaps of a soaking wet dog shaking the water from its coat. A fast shutter speed will freeze the dog's motion and catch the droplets of water in mid-air. You can also try catching the dog running, panning the camera at a slow shutter speed to blur the background.

Portraits of dogs with their owners can be very successful, as there is almost always a clearly defined relationship between owner and dog which you can try to bring out in your photographs. Since there is such a marked difference in size between one subject and the other, you can achieve a much tighter composition by asking the owner to stoop to the level of the dog. At this point he or she will find it easier to talk to, or play with, the animal, giving a more relaxed and natural portrait than you would achieve by asking them to pose standing together. Puppies or very tiny dogs photograph well seated on their owner's laps, or carried in their arms so that the two faces come closer together in the composition.

Cats, on the other hand, are less easy to control but make more photogenic subjects. Simply photographing cats when and where you find them can be quite rewarding, for they are to be found, more often than not, in attractive or at least intriguing situations—perhaps surveying the scene from the top of the garden wall or from a windowsill, or curled up in the best armchair or the only patch of sun on the front doorstep. Watch out for the animal's favourite haunts, where it is most relaxed, and concentrate on these places. Cats are natural climbers and the background of foliage that a tree gives will provide an attractive setting. In this instance, a telephoto lens will enable you to frame the picture more closely.

By choosing a natural setting like this you are more likely to have a view into the world of a cat. You can even try to

John Daniels/Ardea

Puppy *Filling the frame with the puppy emphasizes its size in relation to the enveloping leg of its mother.* **Black cat** *The bare branches provide a pattern of pale shapes which contrast well with the round, black form of the cat.* **Girl and rabbit** *For a portrait of pet and owner, try to bring the two faces together for a tight composition*

A. Saucez/Explorer

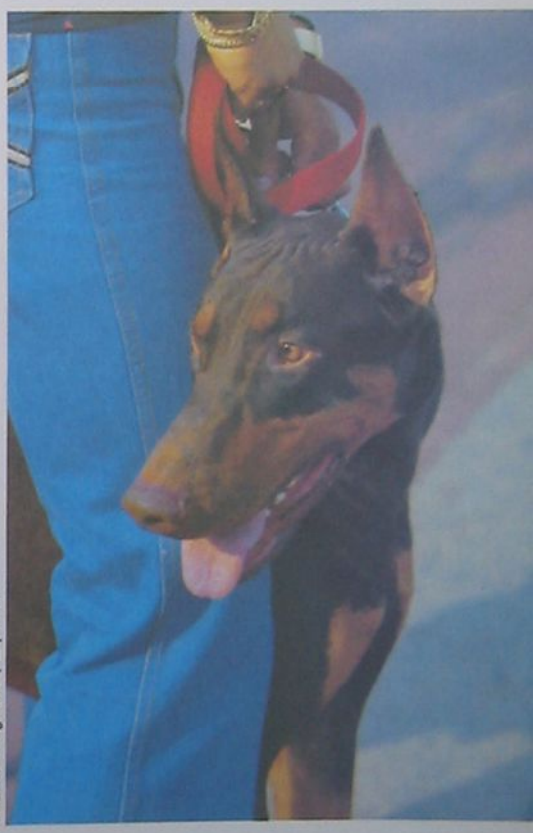
capture the animal unawares, either by stalking it through the undergrowth or using a remote control camera.

These animals respond to food very differently from the way that dogs do, becoming quite receptive after a meal, and it is not difficult to coax cats with their favourite titbit. The most successful way of tempting a cat towards a more promising background, however, is by providing warmth of some kind. A hot water bottle, strategically placed, may attract a cat to your chosen setting, and the warmth created by tungsten lamps can achieve a similar effect. Once you have attracted the cat to your chosen lighting set-up, use sidelighting to help bring out the detail of fur and whiskers. You may be lucky enough to catch a cat's shadow in certain lighting conditions, when it can contribute very dramatically to a composition. A cat may be upset by flash, but in a situation where you must use flash lighting, diffuse it or bounce it off a wall or ceiling wherever possible, or there will be an ugly shadow to one side of the animal. Whatever the picture, try to keep a cat's face in sharp focus and you will catch even the most delicate expression.

Jane Burton/Bruce Coleman Ltd.

Jean-Paul Ferrero/Ardea

On the tiles *A high viewpoint and close framing with a telephoto lens achieved this successful picture.* **Parrot and statue** *Choose a viewpoint which sets a light subject against a darker background for a well-defined image.* **White cat** *A warm windowsill is an excellent place to photograph cats, while their attention is directed elsewhere. A low viewpoint will help to reveal their distinctive shape.* **Dog leg** *Cropping in closely so that only the essential elements of a scene are shown often results in a very successful composition, eliminating any background distractions*



Chantal Regnanet/Explorer

If you have a black cat as a model, you can take an even more challenging picture by photographing it in the dark. You will need a matt black background, a small torch to help you to focus and a cooperative cat. Once your cat is in an agreeable pose, use a small flashgun from one side to illuminate the tips of its fur, whiskers and eyes. With some luck, you will create a very interesting picture, as the image will consist almost entirely of the shine on the cat's fur and whiskers. In a more ordinary light, when photographing a black cat, you may have to increase the exposure by one or two stops to capture details effectively, particularly if most of the frame is filled with the animal. A white reflector can help to fill in details on a dark coat.

Kittens are probably at their most attractive when playing, and can be enticed very easily with toys or balls of wool. Once again, you can enlist the help of the owner or a friend to manipulate the toys, while you concentrate on capturing the best expression. If you find it difficult to focus on the rapid movements involved in such play, it can help to prefocus on one of the toys and wait until the animal comes into focus. In this case, your pictures will be much more successful if you get right down to the creature's own level, lying on the ground, if necessary.

Some of the most popular pets with children are the smaller mammals, such as rabbits, mice, gerbils, hamsters and guinea pigs. With these animals, pictures of feeding, apart from keeping them in one place, definitely add interest to the picture. If you prefer to show them out of the cage environment, make use of a table top, which you can cover with a piece of material to provide a colourful

F. Belmont/Tony Stone Photo Library

Gili Bernard/Oxford Scientific Films

Tropical fish make very colourful pets, and can provide spectacular subjects for photography, but the humble goldfish can also prove worthwhile, if treated creatively. You may need to use flash, but will need to take several experimental pictures, since light does not pass through water to the same extent as it does through air. Two flash heads give the best result, both pointing down just above the camera from a position of about 45° to the glass. To remove the possibility of an unsightly reflection of the camera itself it is a good idea to mount the camera with the lens looking through a matt, black piece of cardboard. This effectively masks off the looking through a matt black piece of hardboard painted light blue can be fastened inside the aquarium across the back to prevent any reflections from the rear glass.

Shaking hands *Positioning subjects so that the light reveals simple outlines can work well*

Cat nap *It helps to find a foreground colour which is a good contrast to the animal's coat*

background. Blue works particularly well with these animals. Alternatively, you can set up the table top with pieces of rock, foliage or pebbles to make it resemble a more natural environment.

Rabbits and guinea pigs are natural models and will stay still for some time. Gerbils, mice and hamsters will all stay still long enough to be photographed if they are placed on wire mesh, since they do not like the feel of wire under their feet and will freeze until they get used to it. Once these smaller animals do move, their actions are likely to be quick and sharp, and it may be better to move the camera distance rather than trying to refocus. If you want to fill the frame with the animal, a standard lens will not be much use to you, but a medium telephoto will be ideal. If a standard lens is the only one you have, try to include the owner in the picture. This may be a good idea in any case, but is particularly appealing if a child is concerned. Smaller animals, such as mice, can easily be perched on a shoulder, bringing the child's face into close proximity.

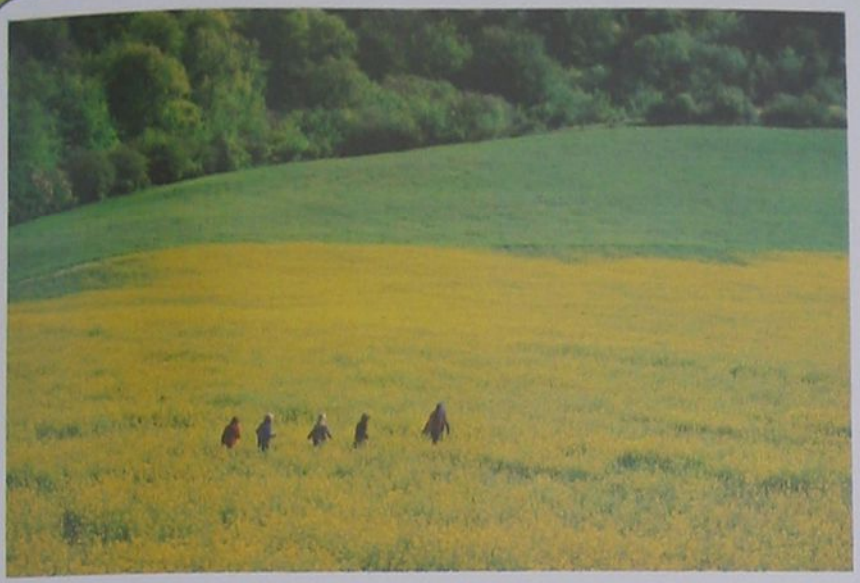
Although pet birds can be treated in a broadly similar way to the smaller animals where photographing them is concerned, the cage does have the advantage of keeping the animal in a confined space, and eliminates some of the problems caused by sudden and rapid movement. Clearly, a cage with a glass front is ideal for this purpose, but you can hold the camera right up to the front of a wire cage to throw the mesh out of focus. Watch out for mirrors and other reflecting toys in the cage, if you are using flash, and hold the flashgun against the wire, or you will get a reflection from the mesh. A diffuser on the flash will help to prevent shadows of the wires.

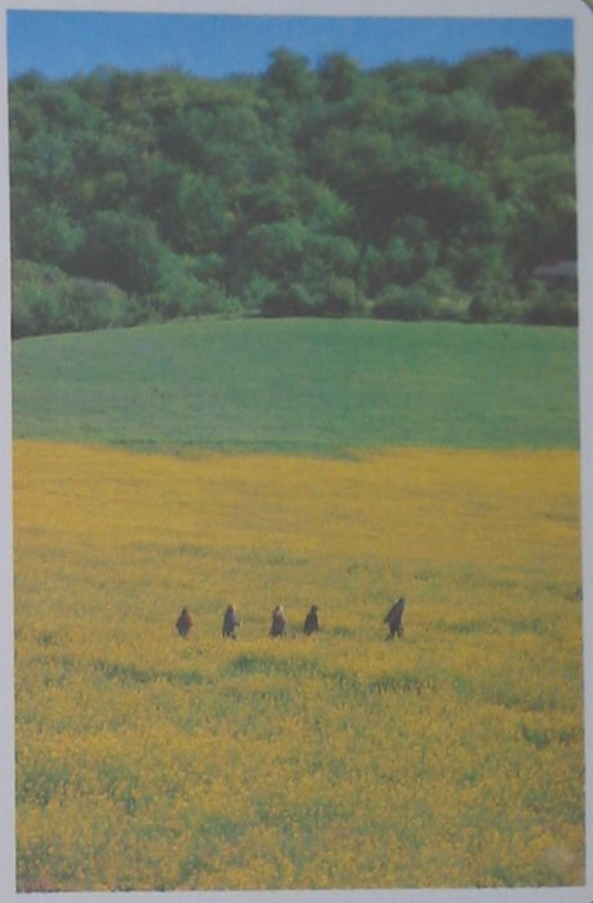
Ken Lewis/Animals Animals/Oxford Scientific Films

What went wrong?

Figures in the frame

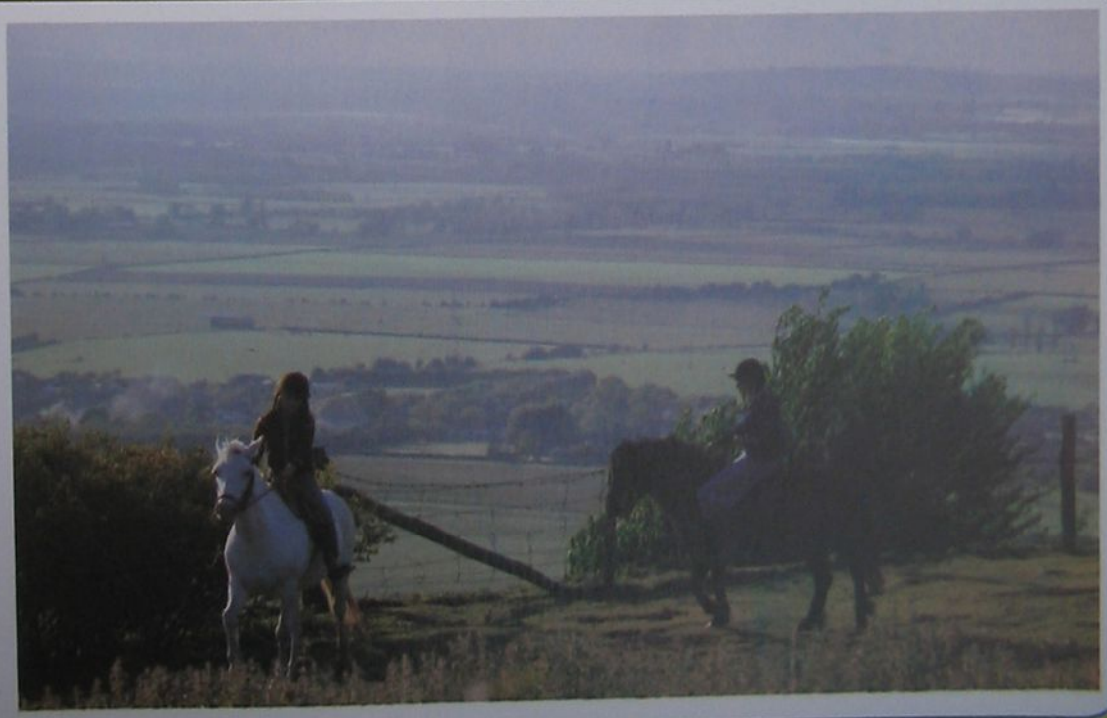
Even after you have learned to avoid obvious photographic mistakes you will find that many other factors can spoil a picture. Here, Sergio Dorantes criticizes some apparently well-taken shots





These pictures show different approaches open to the photographer when composing landscapes—that is, whether to use the vertical or horizontal format. Here, the vertical picture (right) is the less successful of the two for a number of reasons : the thin strip of sky at the top of the frame and the cottage at the right distract from the main subject of the picture, which is the children walking through a mustard field ; also, the central placement of the figures produces a rather dull composition. On the other hand, in the shot above, the subject material is immediately clear and the off-centre group gives a pleasing balance. In addition, the use of only two colours, a warm foreground and a cool background, reflects a more thoughtful composition—these blend harmoniously in the horizontal format

This shot fails to have any impact on the viewer. Too many elements are included and there is not a single arresting focal point. The horses and riders—supposedly the focal point—are randomly placed and not effectively isolated from the general scene. The picture could have been substantially improved with just a little careful thought and a few techniques. First, a graduated filter would have helped balance the difference in exposure between the foreground and background—strong side-light has caused overexposure of the background ; a close-up reading taken through a longer lens would also have ensured more even contrast in exposure ; differential focusing would make the riders sharper and crisper ; and a different angle of view or composition would have helped considerably



Creative approach

Sea craft

Whether shooting skiffs or supertankers, the photographer has to work even harder than usual to take creative pictures and avoid straightforward record shots

There are so many romantic associations with ships that, at first sight, they seem easy subjects for the photographer. But, although photogenic, ships can be difficult to photograph in an original way, and many of the pictures taken are straightforward shots with little attempt at creativity.

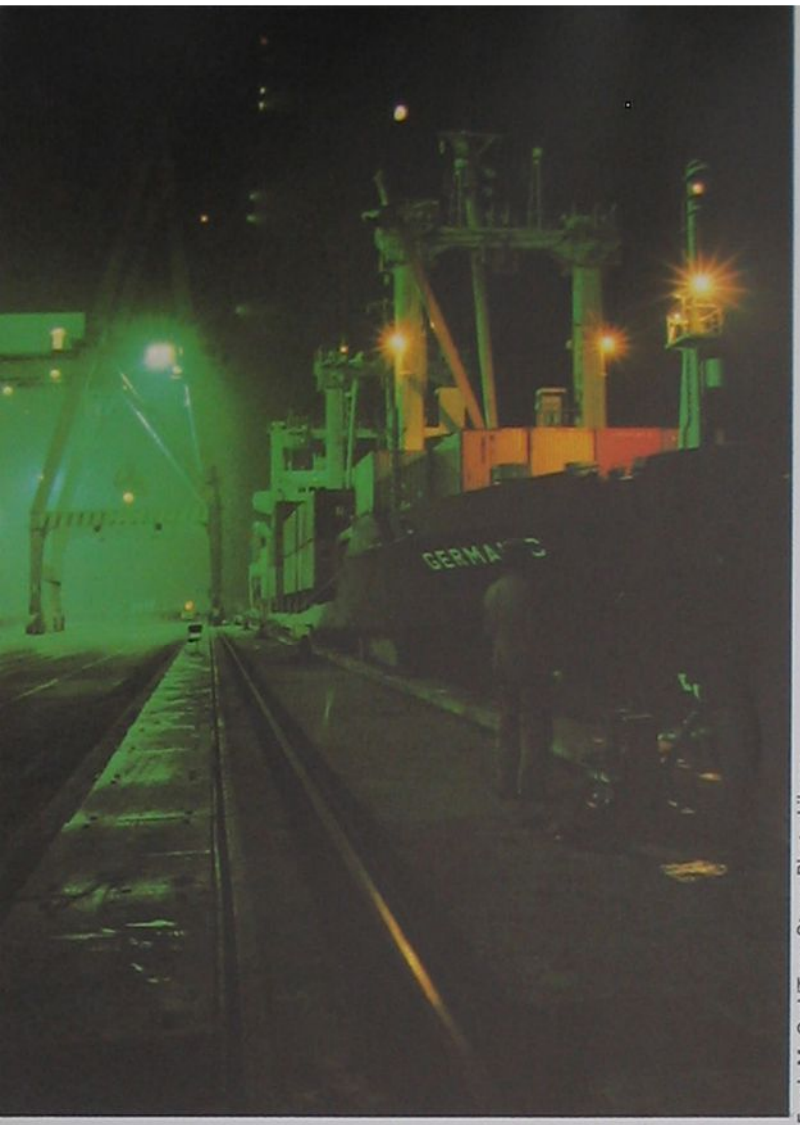
Smaller craft—boats and yachts—are generally easier to photograph. For one thing, they are more accessible for most people, since they can be seen in any creek, inlet or harbour and on many inland stretches of water. They range from brilliantly painted dinghies to Arab dhows under full sail. Many small craft have simple, sweeping lines which make it possible to compose the graphic images which are often so successful.

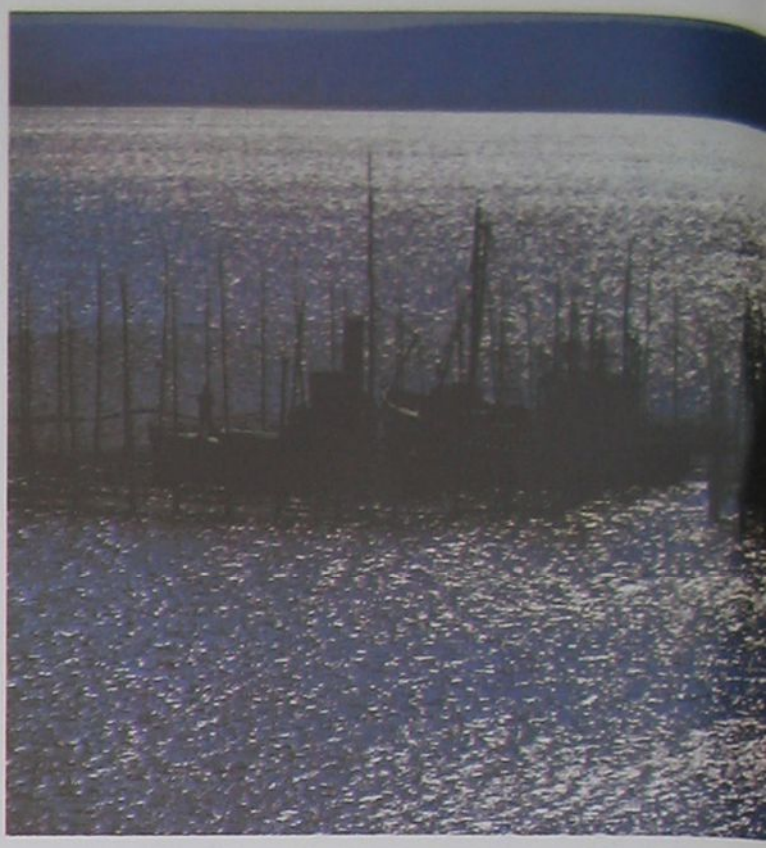
With small vessels, it is possible to use all the conventional approaches to photography—changing viewpoint, altering lenses and moving round the craft—even if it means crossing to the other side of the river—to get the best shots. Sailing boats in particular benefit from changing light, for example when a sail has a smooth curve of shadow across it. Telephoto lenses make the most of the shapes of sails, and can also be used to close in on crew members as they handle the boat, especially when they tack in near to the shore. A useful characteristic of sailing boats is the way they heel over in a cross wind or when tacking—the strong diagonal this creates is a valuable compositional element in a picture.

John de Visser

Red and white *Here, the main subject—colour—is used as a vehicle to underline the boat theme*

Evening mooring *With a wide angle you can use a device, such as this rope, to lead the eye into the shot, bringing it to rest on the main subject*





Frank M. Orel/Tony Stone Photo Library

Silhouette *Direct sidelighting creates an unusual effect on the ripples on water, and the subject can stand out as a dark silhouette in contrast*

Quayside at night *Photographing at night can lend an interesting atmosphere and colour to an ordinary scene, and a starburst filter transforms each point of light*

Small vessels can also be photographed close to from all angles when they are laid up on the beach or in a harbour at low tide. The shapes of the hulls are always attractive, and a favourite viewpoint is from directly in front of, or behind, the boat. With vessels of all sizes, mooring ropes can often be used to advantage—take your photograph with the camera very close to the rope, looking along it to the boat. This will lead the eye into the picture, and the rope can be used to fill up an otherwise empty foreground area of the picture.

Small details of boats can also be turned into semi-abstract pictures, and you can spend a considerable time simply photographing the juxtapositions of bright paintwork, ropes and gleaming polished metal. There is always some sort of maintenance work going on wherever boats are to be found, so the possibilities are numerous.

In the still harbour waters, you can experiment with reflections. Try composing very tightly to create a complete abstract, maybe including part of the vessel's waterline as a clue. Most people do not need any prompting to photograph yachts bobbing at anchor at sunset, with their spars silhouetted against the sky and the colourful reflections in the water. But beware of believing that you are taking a masterpiece—it has been done thousands of times before.

Small coastal craft are also comparatively accessible and photogenic, particularly fishing vessels. These often have masts to carry sails or to help in landing the catch, so a good shot to take in harbour is one using a telephoto lens to compress all the rigging into a forest of masts and ropes, ideally with the bows of one or two boats to give context. This is one occasion where a 'confused' picture is effective, but the bows of the boats are needed to help the viewer make some sense of the shot. Otherwise, simple images are generally the most effective.

A telephoto lens is also useful as a fleet leaves or enters harbour, particularly if you can get a low viewpoint.

Among the most attractive vessels in the world are Arab dhows and feluccas, with the distinctive triangular lateen sails. These are still in regular use as trading vessels around the Red Sea and Indian Ocean, and can be surprisingly large. The strong diagonal of the boom of the lateen is immediately appealing in a photograph, and even if the boat is a small element in the shot, the eye is immediately attracted to it.

Larger modern vessels, however, suffer badly in many photographs. Their functional lines lack the grace of the dhow or any other sailing vessel, and they are often far out to sea, making it hard to take anything other than a straight telephoto shot of a distant shape on the horizon. When in port they are either behind dockyard gates or only visible from a distance and from restricted viewpoints.

Indeed, difficulty of access is the most awkward aspect of photographing ships, whether they are merchant vessels or warships. If the ship were at sea and one had complete freedom of movement around it as it crashed through the waves, there would be ample opportunity for dramatic shots. The most successful viewpoint is often directly ahead of the vessel, and this works well even if the ship is some distance away and you are using a telephoto lens. If you could get close to a liner or other large ship at sea, some exciting shots could be taken with a wide angle lens from water level with the hull towering over you.

But given the problems of inaccessibility, how can you take pictures which are more than simply record shots? Almost inevitably a telephoto lens is needed, though even with a 400 mm lens a ship still appears small in the frame unless it is closer than a kilometre or so. If the vessel is distant, it may seem a good idea to take a picture anyway—but consider whether you really want more than a couple of shots of a distant ship perched on the horizon. These pictures are usually very dull, and the depth

John de Visser

of atmosphere between camera and ship often produces a strong blue cast that you can do nothing about.

A couple of variants that you might try, however, are to move right down to sea level, so that the waterline of the ship is broken up by waves closer at hand, making it seem more vulnerable to the elements; and also to experiment with changing the position of the horizon in the frame—bisecting the frame, with the ship in the centre, is uninspiring. Alternatively, use land based objects to frame the sea, relieving the effect of vast expanses of water and sky. Even a nearby figure, out of focus, pointing at the ship, would add an extra element of interest to the picture.

If you are photographing vessels at comparatively close hand across a harbour or dock, a long telephoto can also be useful for producing simple, graphic, almost abstract shots. Do not worry if you cannot include the whole outline of the ship, but concentrate on shapes and, if possible, colour. Avoid centring all your pictures on the deck line, but study the waterline as well. A sense of scale is particularly valuable, so any shots of workers painting the hull are useful.

The photographer's greatest ally is always the light, and not just bright sunlight. Many types of weather and lighting conditions can help what would otherwise be an ordinary looking shot. Mist can add an air of romance, or can obscure undesirable elements so that they appear as blurred, hazy shapes.

Stormy or showery weather is excellent for photography of ships, even in harbour, as there are strong emotive links between bad weather and ships. Wide angle shots may emphasize the weather conditions as long as the ship is not too small a feature in the picture.

At large ports it is generally possible to take boat trips around the harbour, which gives the opportunity to see ships in close-up. Take a wide angle lens with you as well as a moderate telephoto or zoom lens, since you may be able to take pictures from below the deckline. A wide angle is also very valuable if you are on board any vessel, whether it is a trawler or a liner, since there are many features which are difficult to accommodate with any other lens, such as superstructures and sails.

When on board a vessel, the usual rule that you should match your shutter speed to the focal length of the lens is often misleading. The constant movement of the vessel, even in calm weather, can mean that a speed of 1/125 is necessary with a standard lens. A wide angle will help to overcome problems of blur and depth of field, as will faster film than you generally use. Lack of light when photographing down from deck level into the sea can also catch you unawares—even in brilliant sunlight, the sea is surprisingly dark and a fast film may be needed.

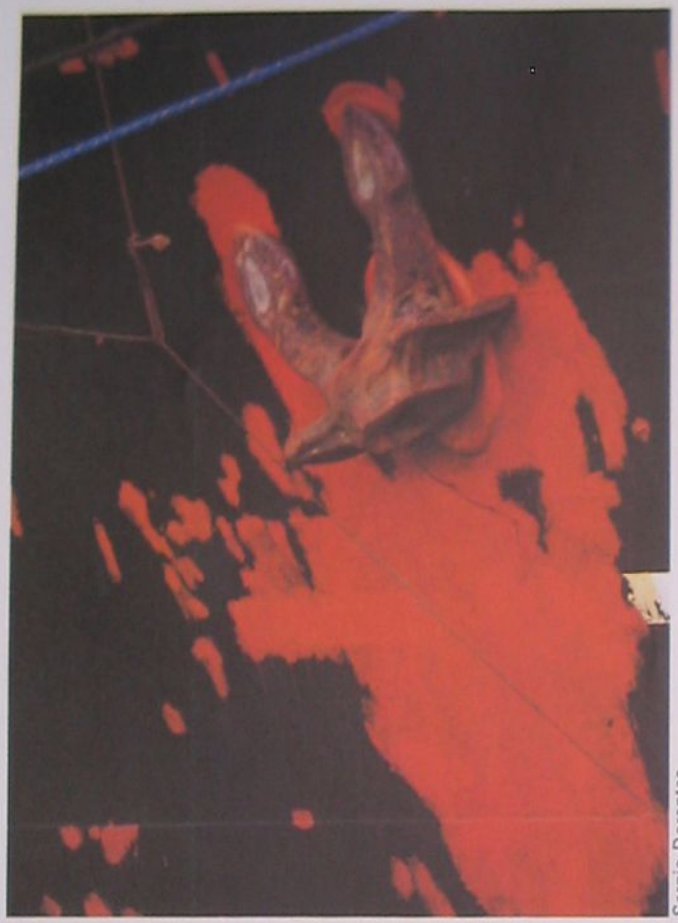
A final point to remember is that whenever you include a sea horizon in the picture, it must be completely level—any errors in alignment show up clearly against the rectangular frame. If at sea on a pitching boat, frame to exclude the horizon—shooting down at the sea or up at the sky—or leave space around the subject for subsequent cropping.

Key points

- With small vessels, and when photographing details of larger ones, keep compositions simple and aim to concentrate on shapes
- Fill empty areas of sea and sky if possible unless these are a deliberate part of the picture
- Pictures with the vessel centrally placed in the frame are frequently uninteresting—vary the composition
- Make use of weather conditions to add drama where possible
- If possible, get close to the vessel at the waterline for dramatic wide angle shots
- When on board ship, a wide angle lens may be very useful. Allow for the movement of the ship when choosing shutter speeds
- Telephoto lenses are useful for composing abstract shots and emphasizing patterns and perspective

Ian Griffiths

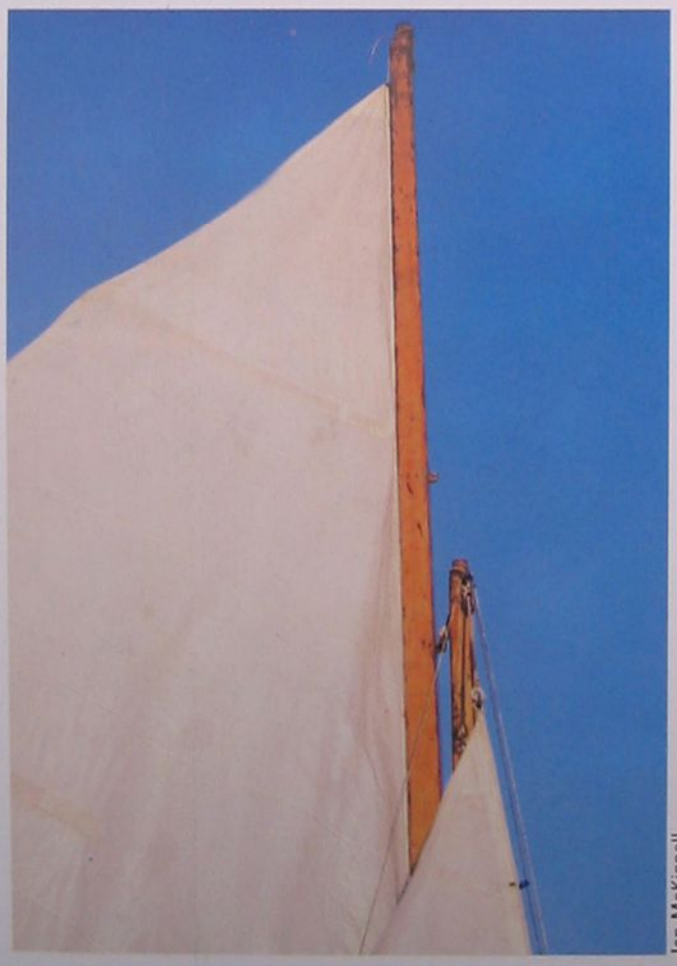
Estuary *If the main subject is distant and small in the frame, you can use a strong foreground element to complement and balance it. Here, the old discarded machinery leads the eye directly to the decaying hulk in the centre of the frame*



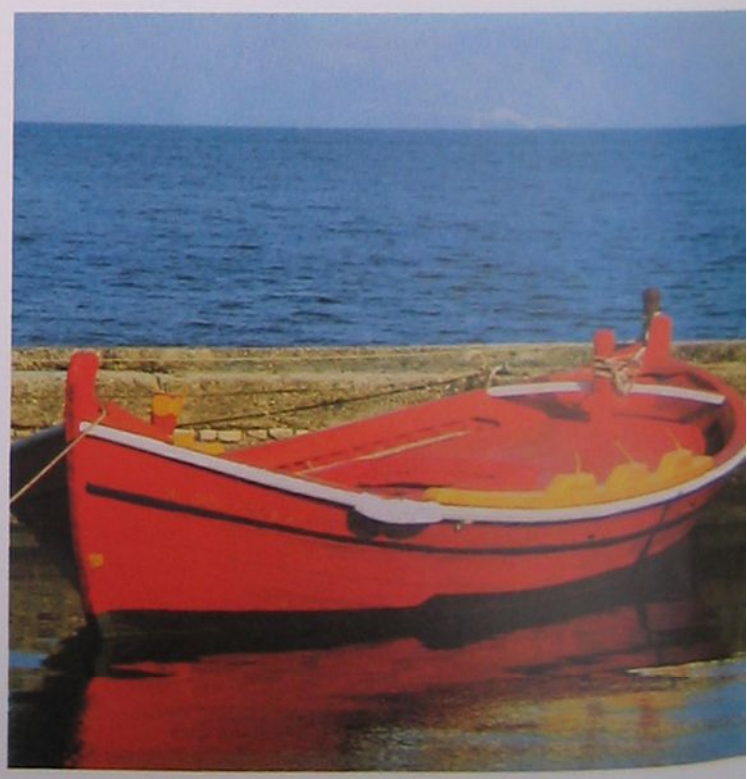
Sergio Dorantes

Anchor *Do not overlook the pictorial potential of old, rusting metal or tattered paintwork which can often make a good close-up. The anchor provides a point of interest in this shot.*
White sail *Careful framing with a telephoto lens helps to produce an image in which shape, line and colour form the basis of an abstract design*

Fishing net *Focusing on the net, and allowing the boat to appear as a hazy yet distinctive shape creates an unusual picture.*
Red boat *Telephotos give you endless opportunities to compose strong designs with colours and shapes. A carefully chosen viewpoint helps cut down unwanted elements appearing in the frame composition*



Ian McKinnell



John de Visser

John de Visser

Cable *Harbours often have poor foregrounds and ships may be small in the frame. This picture shows an imaginative way around the problem.*

Bird's eye view *In this case, a strong image has been created not only with the aid of an unusually high viewpoint, but by the deliberate positioning of a dramatic diagonal line*

John Garrett

Jerry Young

Advanced toning

If you have mastered simple toning, you can try more advanced toning techniques. And using special dyes you can greatly expand the range of colours and possible effects for toning your prints

Lawrence Lawry

Standard toning techniques can give a variety of subtle and pleasing effects with black and white prints (see pages 709 to 713), but colours tend to be rather muted and the range of alternative tones is limited. For unusual or strong, interesting colour permutations, you must use more elaborate toning techniques.

There are two basic advanced toning techniques: dye toning and dye coupling development. *Dye toning* involves converting the silver image of a print or film into a compound which acts as a mordant—a substance that 'fixes' or holds colouring materials—for ordinary, basic dyes. With *dye coupling development*, the silver image of the print is bleached and subsequently redeveloped in colour developer to form a dye image as well as a silver one.

You can prepare the toners for both these techniques yourself using the formulae provided here, or buy one of the commercial toning kits. Both types of toner make use of hazardous chemicals and special precautions must be taken in handling, storage and disposal.

Dye toning *This technique makes use of dye couplers, producing very intense, pure colours. This is because instead of covering the silver you are actually replacing it with a dye image on paper*

Dye toning

To replace the silver image with a dye, start by washing the print original thoroughly—it is not necessary to dry the print after processing—and then place it in a mordanting bath consisting of four parts water to each part of the stock (see panel).

Leave the print soaking in the mordant bath until the image is reduced to a light brown colour—the metallic silver is converted to uranium ferrocyanide, which acts as the mordant. Then wash the print for a few minutes. It is now ready to be placed in the dye that gives the colour you want.

Leave the print in the dye solution until it is the right colour, and then wash for five to ten minutes. Any residual colour causing a cast on the print's paper base can be removed by a brief rinse in a *cleaning bath*.

Tanya George

Making your own toning bath

Chemicals for dye toning

Mordanting bath (stock solution)

Oxalic acid	4 g
Uranium nitrate	8 g
Potassium ferricyanide	4 g
Water to make	1000 ml

Dissolve each chemical in 15 ml water and add together in the order given. Store the stock solution in dark bottles and away from the light.

Dye solution

Red	—Rhodamine G
Orange	—Auramine
Yellow	—Chrysoidine
Green	—Malachite Green
Blue	—Methylene Blue
Violet	—Methyl Violet

Dye	0.2 g
Acetic acid (10% solution)	5 ml
Water to make	1000 ml

Dissolve the dye in hot water and filter it. Add the acetic acid and cold water to make up the litre.

Cleaning bath

Potassium permanganate	4 g
Sulphuric acid	1.5 ml
Water to make	1000 ml

Dissolve the crystals in approximately one litre of water and only then carefully add the acid.

Chemicals for dye coupling

Standard bleach (stock solution)

Potassium ferricyanide	100 g
Potassium bromide	100 g
Water to make	1000 ml

Dissolve the chemicals in a little warm water, and add the rest of the water to make the stock solution. Dilute this stock solution 1+9 for working strength bleach.

Colour developer

Diethyl para-phenylene diamine hydrochloride	2.5 g
Sodium sulphite (anhydrous)	2.5 g
Sodium carbonate (anhydrous)	15 g
Potassium thiocyanate (10% sol)	10 ml
Water to make	1000 ml

Colour formers

To every 1000 ml of colour developer, slowly add 5 ml of the colour former of your choice. Colour formers are normally available as three to five per cent solutions in alcohol, acetone or organic solvent in three colours.

Yellow	—2-5 dichloro-aceto-acetanilide
Magenta	—para-nitrophenyl acet-nitrile
Cyan	—2-4 dichloro-alpha-naphthol

To obtain colours other than these, simply mix varying proportions (to make 5 ml) and add this instead to the stock solution.

Development time is best established by trial and error—the time depends on the intensity of colour required as well as the original characteristics of the print or film material and the exposure and processing this received.

Silver bleach

Copper sulphate (crystals)	100 g
Sodium chloride (table salt)	100 g
Water to make	1000 ml

Add to this, very carefully, 25 ml sulphuric acid. Immerse the print for up to five minutes depending on effect you require. If any stains occur, remove these by fixing the print in normal print fixer for ten minutes and then wash thoroughly.

Using colour couplers for toning

For colour coupler—indirect—toning, start by bleaching an exposed and processed black and white print image. You do this by means of a *rehalogenizing bleach*. This solution sets off a process which converts the black silver image on the print into silver halides—either silver bromide or chloride. The material you work on must be fixed and washed properly. Dry prints must be well soaked before bleaching commences. All steps of indirect toning must be done in normal room lighting. The process can be carried out at room temperature, between 20°C and 22°C.

The standard bleach consists in its simplest form of a solution of potassium ferricyanide and potassium bromide (see panel), but other bleaches—with the exception of Farmer's Reducer which dissolves the image—work just as well.

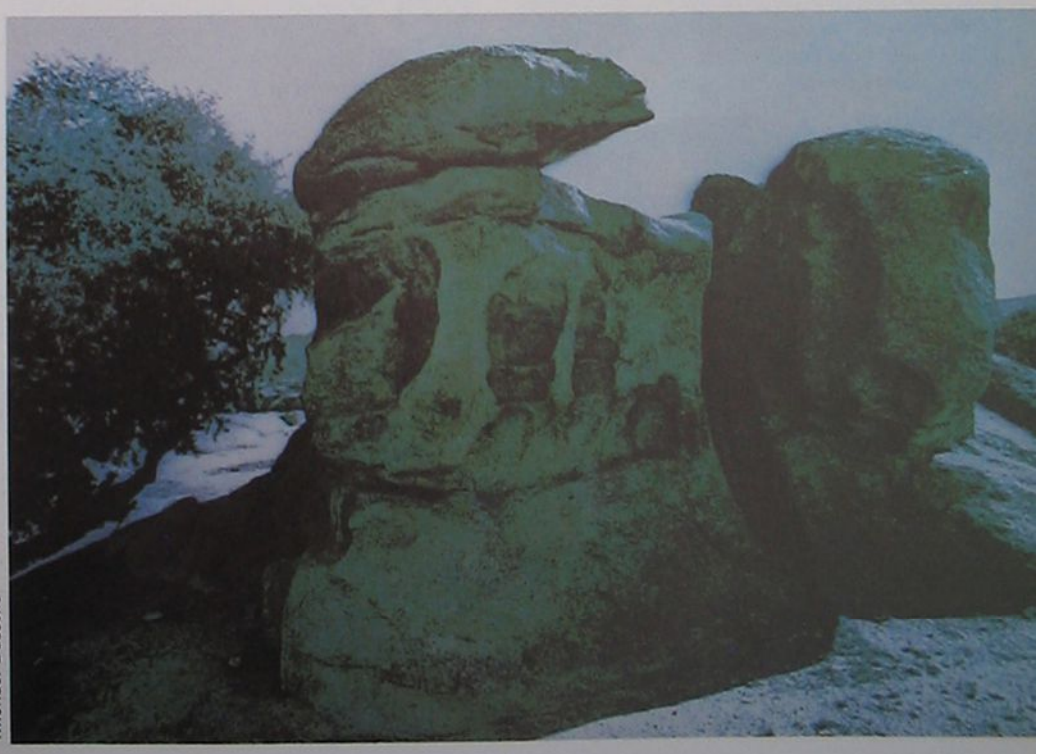
After bleaching, give the print a long wash to clear away all the bleach solution. Then develop the print again in normal room light using a chromogenic colour developer, made up according to the instructions in the panel. This consists of a colour developer and a *colour coupler* or *former* that gives the colour you want. The oxidation products of the developer combine with colour couplers in the solution to produce a stain or dye image at the same time as the silver image is redeveloped. The colour developer should be made up immediately prior to use as it has a short life (5 to 30 minutes depending on throughput).

By careful use of masking such as cellulose or latex paint films, it is possible to use a variety of colour couplers to form a range of colours on a single

Standing stones *With practice, you can achieve a high degree of control when toning a print—delicate effects with subtle colours can be produced*

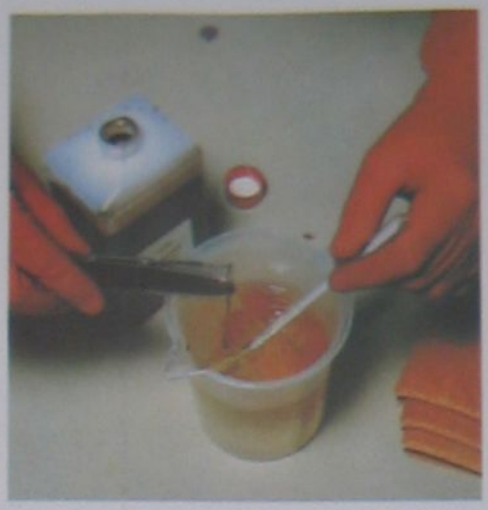
Variation of tone *By simply varying the time which a print spends in the toning solution, you can carefully control the effect and so gain a huge variety of different tones. The longer the print stays in the solution, the more intense the toning effect. The two prints, left, were toned for different times, with noticeably different results. The effect of 'freezing the greys' which is possible only by using the Colorvir kit offers unusual combination of grey and colour (below)*

Michael Busselle



Dye coupling

1 *The Tetenal kit contains a selection of chemicals for direct and indirect toning, with bleachers and colour formers of yellow, magenta and blue*



2 *Start by mixing bleach baths, stop bath, colour developer and stabilizer. Mixed solutions have working lives ranging from a few days to months*

3 *As an example, begin indirect green toning by immersing the processed black and white print in a preliminary bleach bath. A water rinse follows*

4 *Add green colour former to the colour developer solution, which you have already prepared. You can mix colour formers to obtain different colours*

5 *Place the print in colour developer to which former has been added. With direct toning, the unprocessed print is placed in the bath under safelighting*

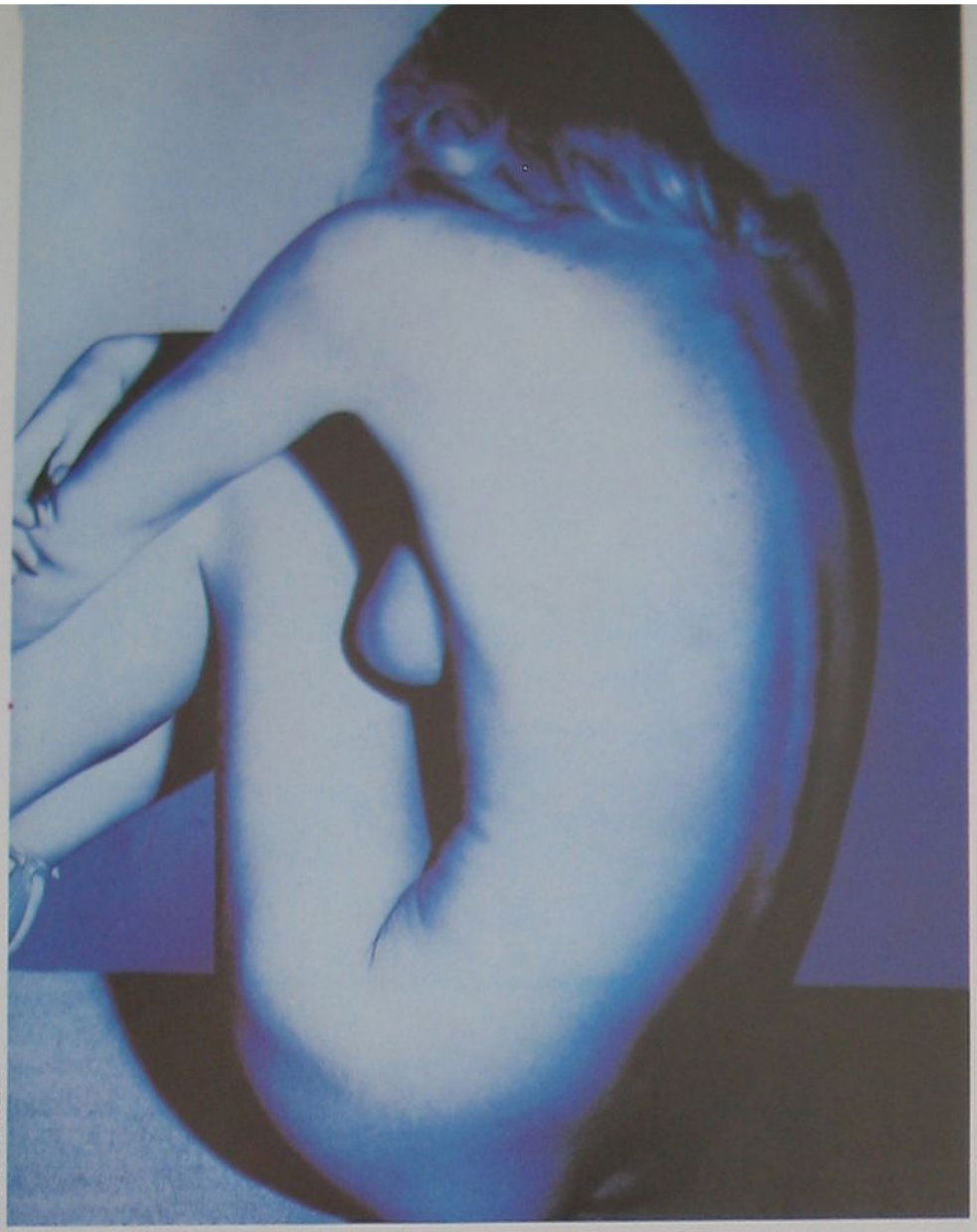
6 *Wait until the print has reached the colour you want then transfer it to the stop bath for the required time, and follow this with a good rinse*

7 *Place the print in the second bleach bath (bleach–fix) for four minutes. This is not used for brown toning, in which ordinary fixer only is used*

8 *This shows the effect of the bleach–fix on the image of the print. After this bath, wash the print thoroughly in water for at least five minutes*

9 *Having washed the print, place it in a bath of stabilizer for a few seconds—this helps to prevent the colour dyes from fading with time*

Jon Bouchier



Michael Busselle

print. But this can look messy, especially where areas of different colour meet, unless you take great care and use the tones sparingly. A generally simpler and often more effective alternative is to partially or totally remove the silver metallic image still present as part of the toned image. The black metallic silver does, however, add considerable depth to the image and if you wish to keep this characteristic, use a stop bath and then wash the toned print after its redevelopment in the colour developer.

If you decide to bleach the silver, you can do this for localized areas of the print by using masking techniques, or you can try partially bleaching the silver by shortening the bleach period. You can use Farmer's Reducer for this but better results are obtained using the silver bleach formula.

Alternatively, you can use surplus bleach-fix—this is usually the most long-lived of colour processing chemicals, and worth keeping if you plan to do toning after a run of colour processing and printing.

Follow the bleach bath with a long wash—five minutes for RC papers, ten for fibre based—then give the toned and bleached material a quick dip in stabilizer solution if you have some left from a colour process kit—a 2.5 per cent solution of formaldehyde will do if you do not. Mix this by diluting 60 ml of commercial 40 per cent formaldehyde with 940 ml water.

Nudes *Unlike the tones produced by the normal dye toners, those produced by dye coupling give very intense colours, as well as clean white tones (above). It is also possible to achieve effects similar to solarization (below)—but be careful to choose appropriate subjects*

Direct toning

An alternative method that uses the same chemicals is *direct toning*, which—unlike indirect toning—is made on exposed but unprocessed black and white material. Start by exposing your picture just as if you were making an ordinary black and white print—exposure influences the colour density you eventually get but does not affect the colour shade, so you may find a test sequence worthwhile initially.

Place the exposed print, still in safe-lighting or complete darkness, in a prewash for about a minute to ensure even processing. Then develop the print in colour developer, varying processing time to give the intensity of colour required. Follow this with a stop bath, fix, and a water rinse. Once the rinse is complete, you can continue in normal lighting with the bleaching, washing and stabilization stages as before.

Commercial kits

A few sophisticated colour toner kits are now available from manufacturers like Tetenal, Pebeo and Colorvir. The Tetenal kit consists of chemicals and colour formers for dye coupler toning, while the Pebeo and Colorvir kits have a range of chemicals which permit dye coupling, dye toning and special effects. Pebeo and Colorvir produce interesting tone effects and the Colorvir system gives a range of unusual permutations which are explained in full in the subsequent Darkroom article in this series.

The Tetenal Multitoner kit makes three litres each of preliminary bleach, stop bath, bleach-fix bath and stabilizing bath, plus 100 ml each of colour formers in yellow, magenta and cyan (each sufficient for mixing with one litre developer).

Michael Busselle

Posing models

Models for portrait photography, whether experienced or novice, need skilful direction and posing if the results are not to look stiff and unnatural

Pictures of people are often described as being 'casual' or 'posed'—usually meaning that subjects look as if they have been caught either quite by chance and therefore look natural, or they appear to be unnaturally stiff and formal. But while casual shots frequently make good pictures, most posed amateur shots do not. This, though, need not be the case—as has often been shown by the great portrait photographers past and present. Few people would say that Snowdon's portraits look posed, despite this being the case. Put simply, such pictures are the result of skilful direction in front of the camera as well as behind it.

Indeed, being able to pose a subject well is an invaluable technique that can give you much greater control over your portrait shots generally and lift your pictures out of the ordinary.

Head and shoulders

In a portrait session, the pose must depend upon what you are trying to achieve. Ask yourself, 'What aspect of this person's character or appearance am I trying to emphasize?'. If your aim is to flatter, then your approach, and your model's pose, must be quite different from a session where your aim is to produce a 'character' picture.

These considerations are especially important with head and shoulders portraits, where attention is principally drawn to the face. A person with a prominent nose might not be pleased with a profile shot—though for a character portrait, the profile might be most appropriate.

Generally, three-quarter face view is the most pleasing for portraits, and this provides, at least, a starting point. Pose the model so that the head can be comfortably turned towards the camera, and the eyes can look directly and easily into the lens. This usually means that the model's shoulders should be angled slightly away from the camera.

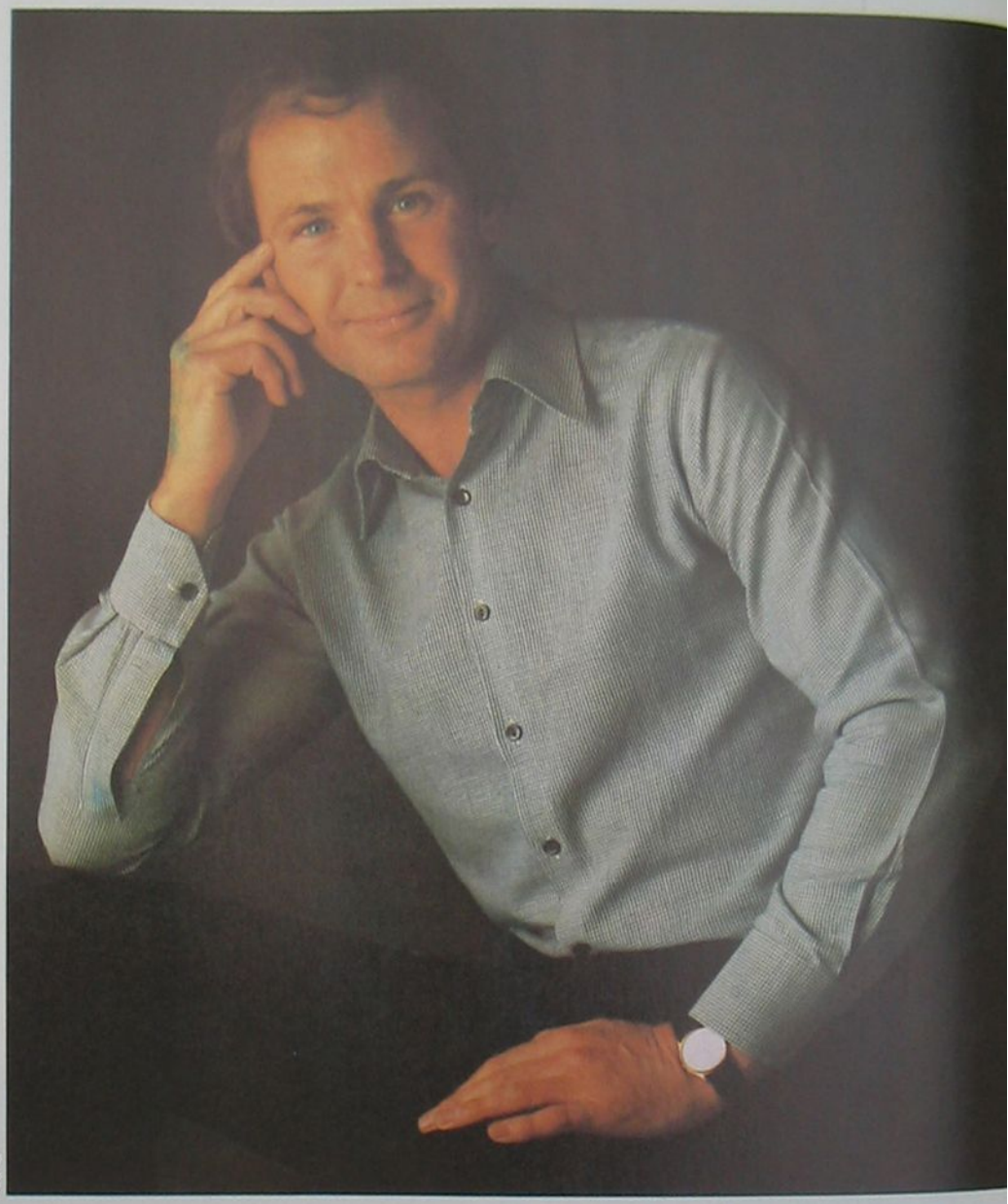
For most head and shoulders portraits, it is best to sit models down. This not only helps to make them more comfortable and relaxed—and so less self-conscious—but it also allows you to shoot easily from a variety of angles. In particular, you can shoot from slightly above the subjects' eye level—a viewpoint that is normally very flattering. Use a chair which enables the model to move easily into a variety of poses, but which does not dominate the picture.

A very effective way of using a chair is to get the model to lean into the picture, perhaps sitting sideways on a low-backed chair, and leaning forward, using their arms and hands as a support on the chair back. This has the added advantage that the hands and forearms can be used as elements to strengthen the composition.

A danger of this pose, however, is that the model can easily take on a round shouldered appearance—this can be avoided by making sure that your model's back is kept straight, and that he or she does not lean too far forward over the back of the chair.

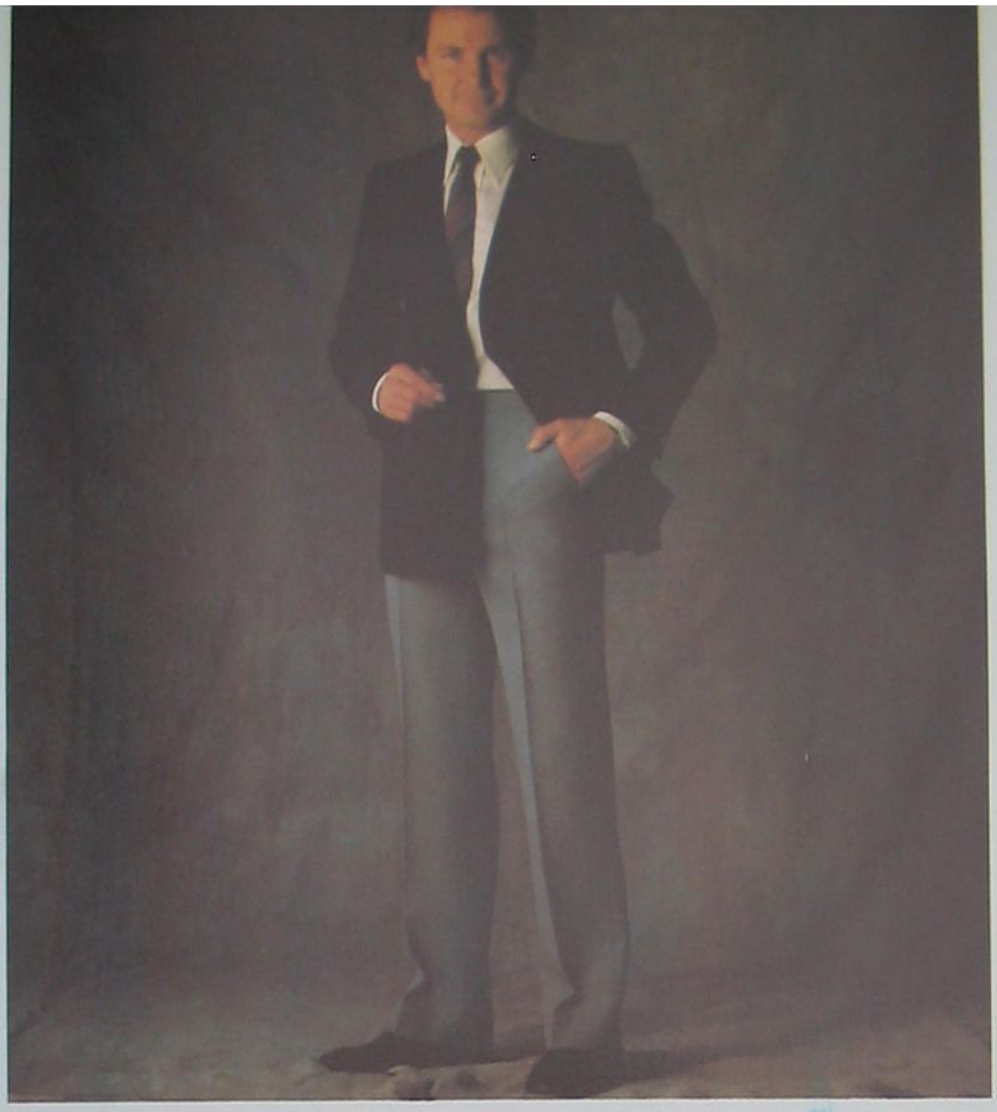
It is important not to forget hands and arms in your pose. If you decide to include them in the picture, they must be arranged to contribute positively to the composition. Otherwise, they may simply look ugly. The backs of the hands, in particular, are rather featureless and with the palms away from the camera fingers often seem to hang like bunches of bananas. Use the hands to help create mood, or emphasize the subject's expression and character—look out for natural gestures while shooting and talking to your subject, and try to incorporate these into the pose.

You can sometimes add life to a head and shoulders portrait by seating your model so that their shoulders are turned away from the camera, even with



Naru

Careful composition *The key to a good portrait is a pose that looks relaxed and natural—a chair often helps*



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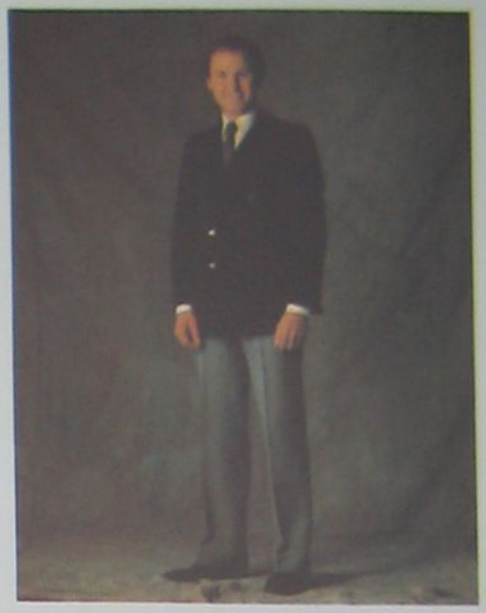


Standing still *Even if your model is perfectly at ease, a standing pose can still present problems. Try to avoid poses where the hands hang limply at the model's sides, as this usually results in stiff, awkward pictures*

the back slightly towards the lens. Ask them to turn their head back round towards the camera just as the picture is taken, but first make sure that the pose does not create unsightly neck creases.

Half-length portraits

For half- and three-quarter length portraits, a slightly different approach is called for. It is inevitable, for instance, that the model's hands and arms will play an even greater role in shaping the appearance of the final image. A chair again makes a useful prop but may, without care, intrude—if the model leans forward across the chair back, the chair may dominate the picture. Nevertheless a chair can be used in many other ways.

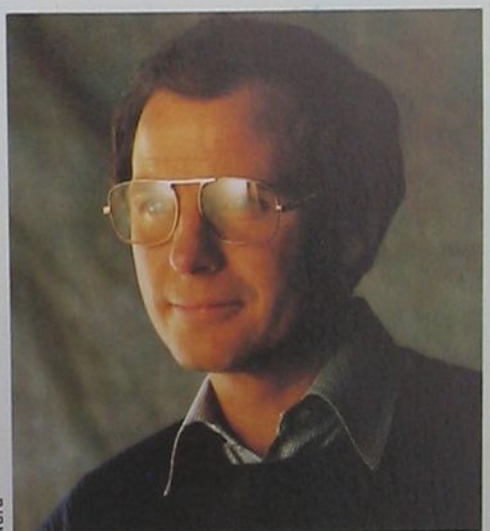
For example, sitting on a chair or stool with the knees drawn up and arms resting on the knees can be a very effective pose for an informal shot. It sometimes helps to provide a box or a stack of books slightly lower for the models to rest their feet on. Arms clasped around a raised knee can also look very natural and informal.

The key to informal poses like this is to give the model something plausible and believable to do in front of the camera. Nothing looks worse than a rigid unnatural pose where the photographer has obviously just said to the model 'do this'. There are many ways of avoiding such a problem—for example, by making sure that the model's hands are fully occupied with maintaining a particular pose. Anybody sitting on a swing, a five-bar gate, or on the edge of a table naturally reaches out to grasp something which will keep them steady, and this produces a strong, energetic composition that can hold a picture together.

Standing poses

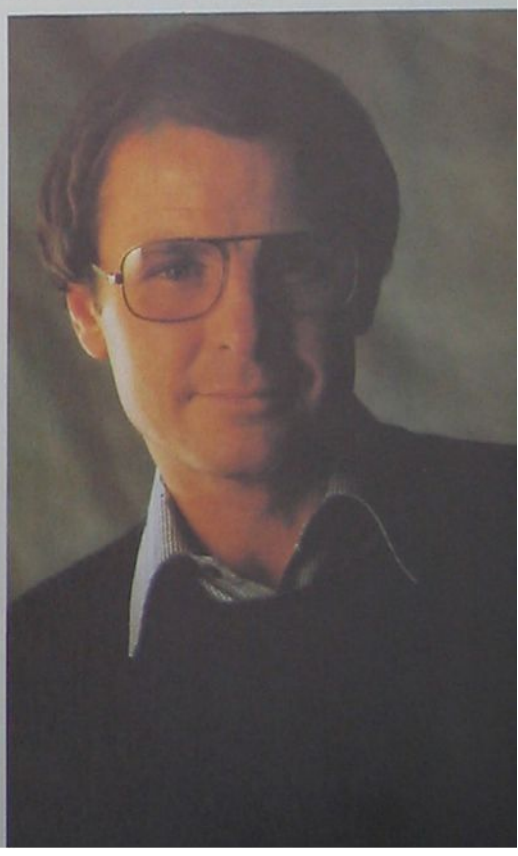
Perhaps the most difficult pose, particularly for an inexperienced or self-conscious model, is a freestanding one. Most people feel awkward when asked to stand still for the camera, and the problem is even greater when there are no supports or props to take hold of. Much of the skill of the wedding photographer, for example, is in helping the guests to overcome this problem, although the task is much easier when two or more people are being photographed together.

A good basic technique for a full length standing pose is to ask your model to take a small pace at an angle of



Naru

Avoiding reflections *If your sitter wears glasses, you must take special care to avoid reflections of the lights or the sky. This is made much easier if there is a dark surface towards which the sitter can turn his or her head*



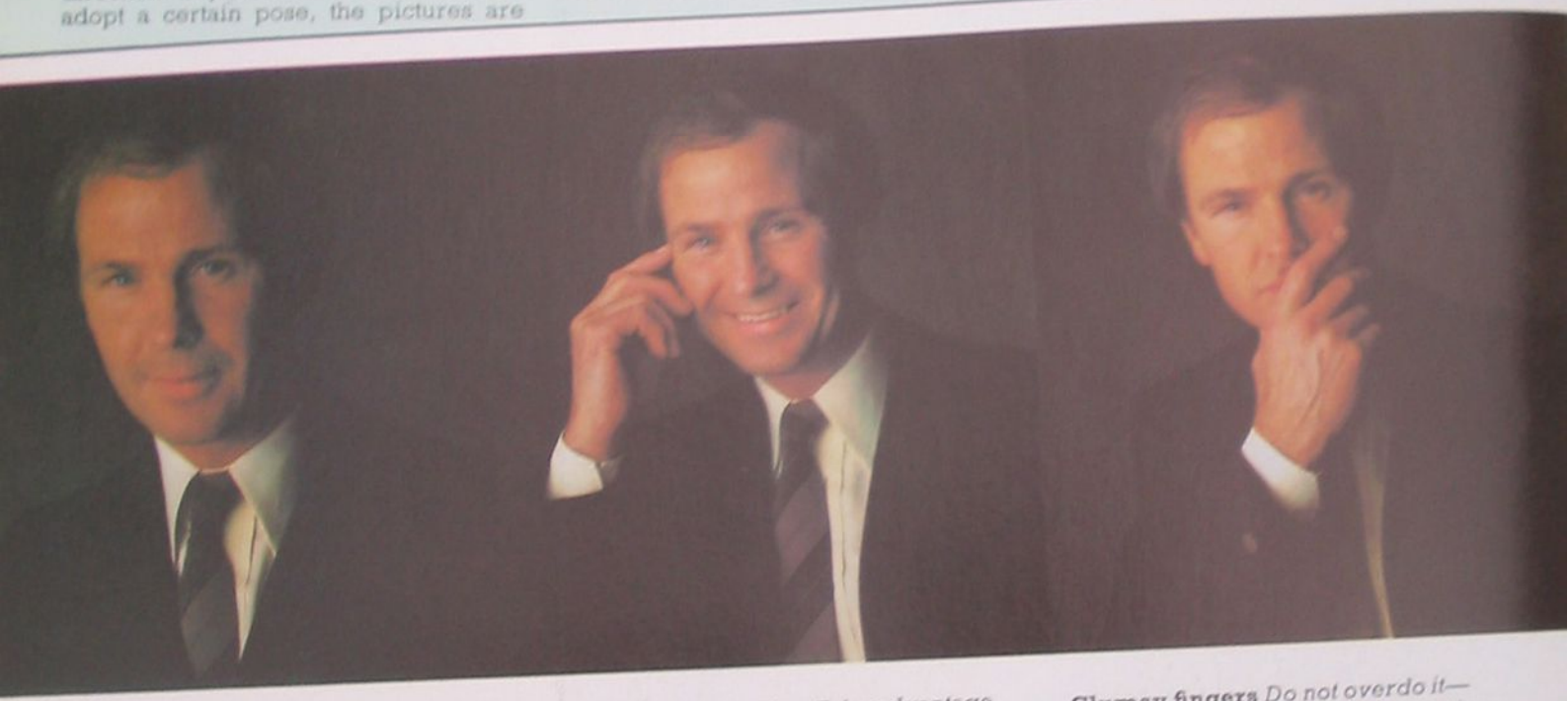
45° to the camera, with his or her weight predominantly on the forward foot. It also helps if the model twists the torso slightly towards the camera, adding movement and life to the picture.

Try to avoid arms hanging loosely—find some pretext for bending one or both arms, with the elbow away from the body. A man, for example, can simply put his hands in his trouser pockets, and a woman can place a hand on her hip or thigh or clasp her hands together at waist level.

If possible, try and get your model to adopt the pose you want by subtle suggestion, rather than by precise direction. If your model cannot readily adopt a certain pose, the pictures are almost certain to look self-conscious and awkward. Good fashion photographs are worth studying for ideas of how a model can look graceful and relaxed when just standing still. In most cases you will find that, although quite static, the model and photographer have managed to introduce a feeling of movement into the picture.

The range of possibilities with a standing pose can be far more varied with nude and glamour pictures—the position and angles of the limbs can be exaggerated, to make an even more dynamic pose. The model's back can be arched and stretched, or the arms raised above the head and clasped behind it, or perhaps entwined in the hair. All these poses help to emphasize the shape and curves of the body, and if done with skill and panache, they can produce very attractive pictures. If the same poses are adopted for conventional photographs, however, they can often look ridiculous.

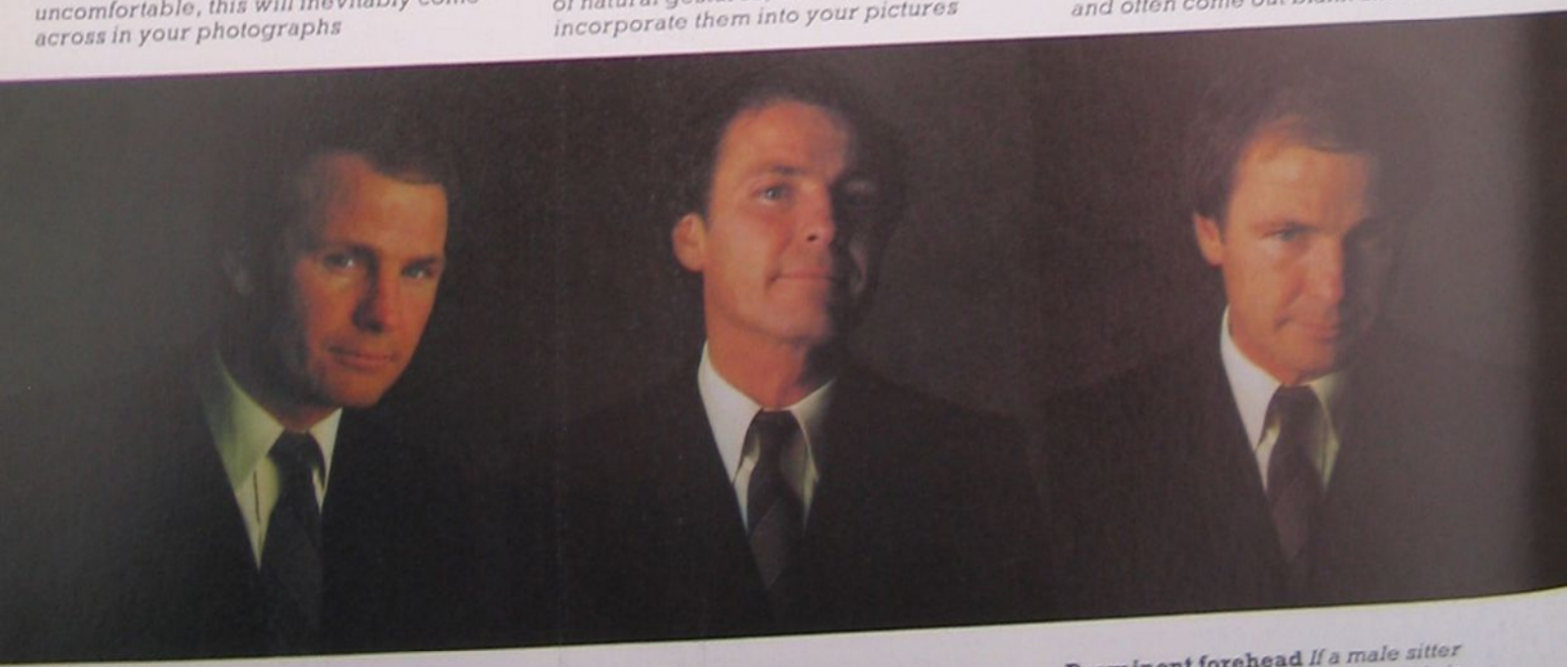
The freestanding pose is probably more effective with glamour pictures than with any other type, but even so, the addition of props and supports greatly increases the number of possibilities. Most professional photographers who specialize in studio shots of girls have an assortment of useful items on hand for



Awkward pose *If your sitter feels uncomfortable, this will inevitably come across in your photographs*

Hands for expression *Take advantage of natural gestures, and try to incorporate them into your pictures*

Clumsy fingers *Do not overdo it—hands can sometimes be a distraction, and often come out blank and featureless*



Shifty look *A sidelong glance can occasionally be effective, but here it merely makes the model look shifty*

Long neck *Unless you are aiming for a very dramatic picture, try to conceal a model's physical peculiarities*

Prominent forehead *If a male sitter has receding or thinning hair, this is emphasized when he looks downwards*

this purpose: a wicker chair to lean against, or a parasol to occupy a model's hands. These and other props are frequently used to aid both the model's pose and the composition of a full length picture.

Besides the more agile standing poses, there are others which would look absurd for conventional portraits, but which are quite acceptable if the model is naked. Poses on the floor are a good example—they are not usually practical for ordinary pictures, unless a very high viewpoint is required, but for glamour photographs or abstract nudes, the floor offers the model greater freedom of movement. The variety of angles and positions for the limbs can be much greater than when sitting or standing, and poses on the floor are particularly suitable where a natural pose is not essential—the model can tense and stretch the body to emphasize lines, shapes and contours.

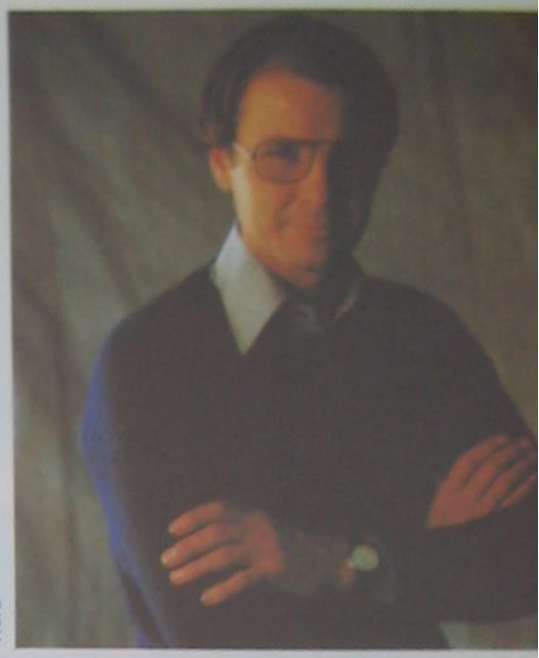
In addition to greater freedom of movement, posing on the floor also allows more varied camera and lighting angles, which can be an advantage in this kind of picture—it is a simple matter, for example, to shoot from a bird's eye viewpoint when your model is posed on the floor.

Using the setting

For a studio session a roll of paper provides a simple but effective background. For location shots, you must consider the background carefully. The location itself often suggests a suitable pose. An indoor portrait, for example, can make use of furnishings and decor as aids to the model's pose, and as elements of the composition. A fur rug may suggest a languorous reclining pose for a glamour shot. For a formal portrait, you could use a polished desk, with the subject seated, arms folded, or elbows propped in an angular, resolute manner.

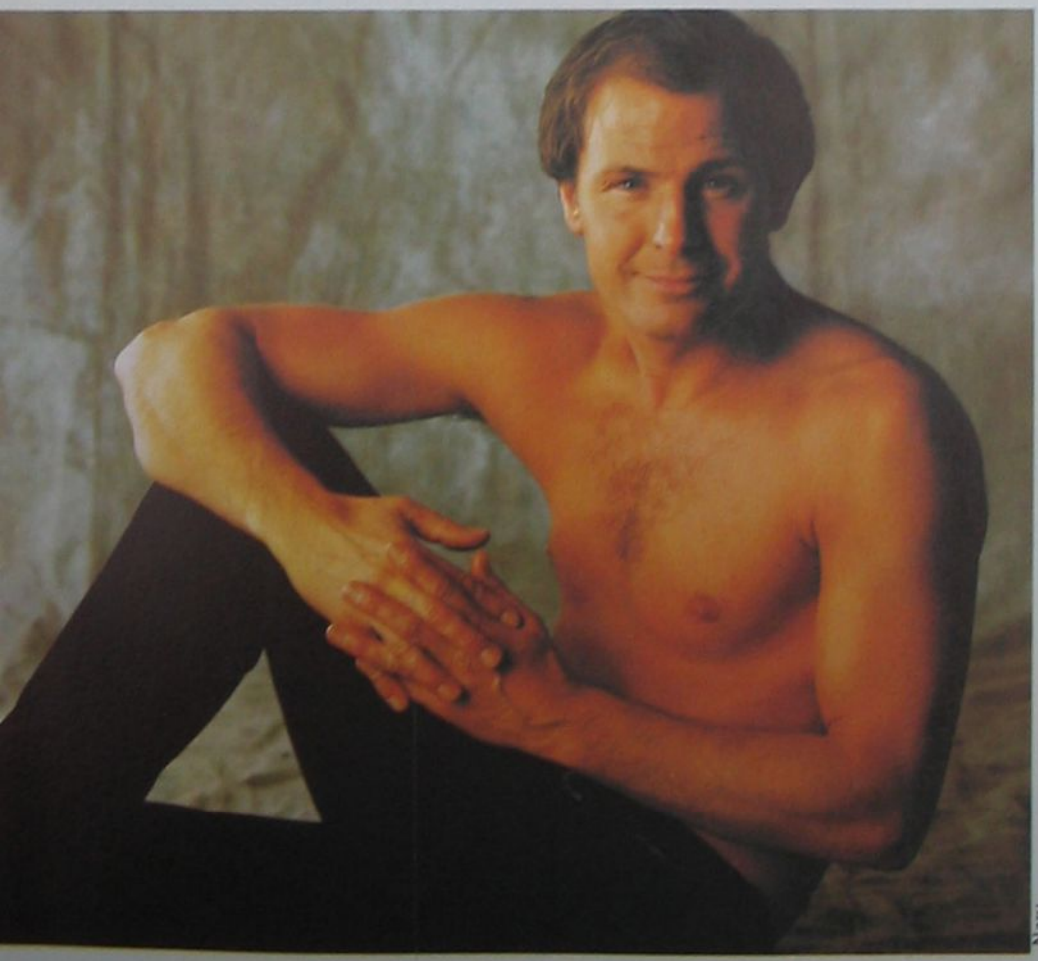
If, however, in posing your model you take your cue from the surroundings, always remember that these must not intrude or dominate in the final image.

Naru



Using the frame *A pose should always be related to the edges of the picture. If you are conscious of the frame edges, you can use them to improve the composition, but carelessness can lead to arms and legs being chopped off*

The human subjects should remain the centre of interest, and all other elements of the picture must play a supporting role—so make sure that the scenery does not upstage the model, perhaps by throwing it out of focus.



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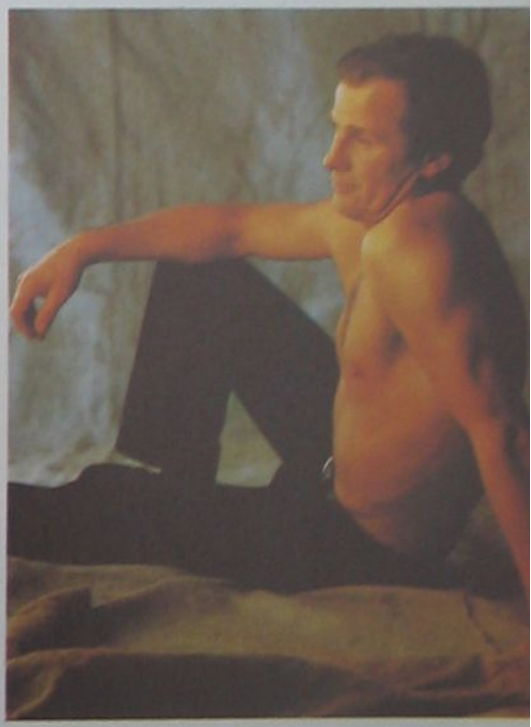


Macho model *Poses on the floor work best with glamour shots—male or female! The pattern of triangles in this graphic composition (left) give the image strength and holds it together.*
Neck creases *If the model's head is turned at an angle, creases in the neck can mar an otherwise good pose*

Assignment

Sergio Dorantes

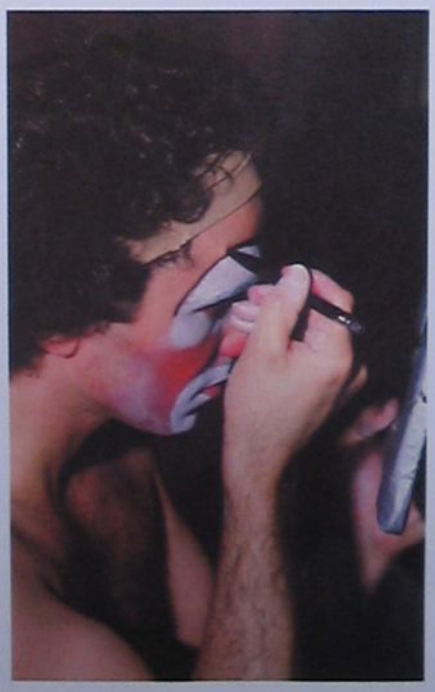
MEXICAN CIRCUS

A circus offers no special privileges to the professional photographer, so for this assignment Sergio Dorantes had to produce good images sharing the same viewpoint as the rest of the spectators

The daring feats of acrobats, the fun of the clowns and the fascinating tricks performed by wild animals are just some of the entertaining acts that go on under the canvas of the Big Top. Coupled with the colourful, and often amusing, activities that go on behind the scenes, a circus is the ideal haunt for a keen photographer.

Visiting 'Circus America' while it was performing in Mexico City, photographer Sergio Dorantes began by asking permission to photograph the performance and what went on behind the scenes. He found that the circus was very cooperative about allowing serious photographers to move about freely since both amateurs and professionals help to promote the popularity of their entertainment. 'They just warned me not to get too close to the animals, not to go inside the ring itself and to be considerate about using flash. For instance, it is not worth taking the risk of upsetting the tigers by firing a flash at them—this could spoil the act and even pose a danger to the trainer'.

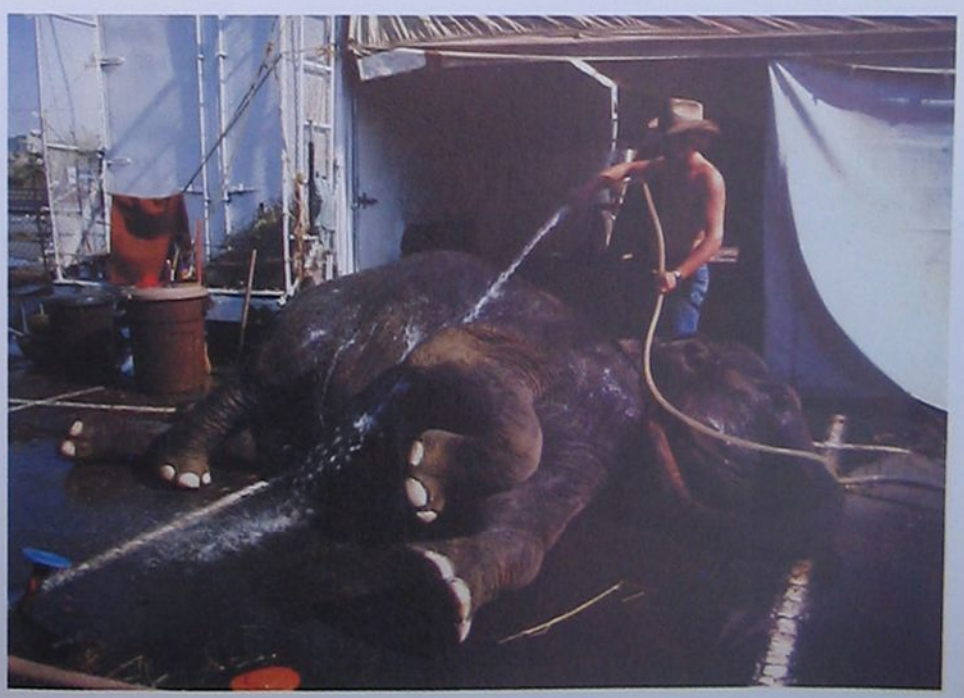
By attending an early performance



first, Sergio familiarized himself with the acts and the lighting so that he could plan his approach for covering the main performance. After the show he had decided on the best viewpoints and that he would solve the problem of shooting in low light by using two separate techniques—uprating Ektachrome to take some shots using available light, and using Kodachrome 25 and a powerful hand-held flashgun for others. He took along all lenses from 16 mm to 200 mm, finding that the latter was quite sufficient for closing in on a trapeze artist. Since space was limited, Sergio used a monopod instead of a tripod for all his shots without flash.

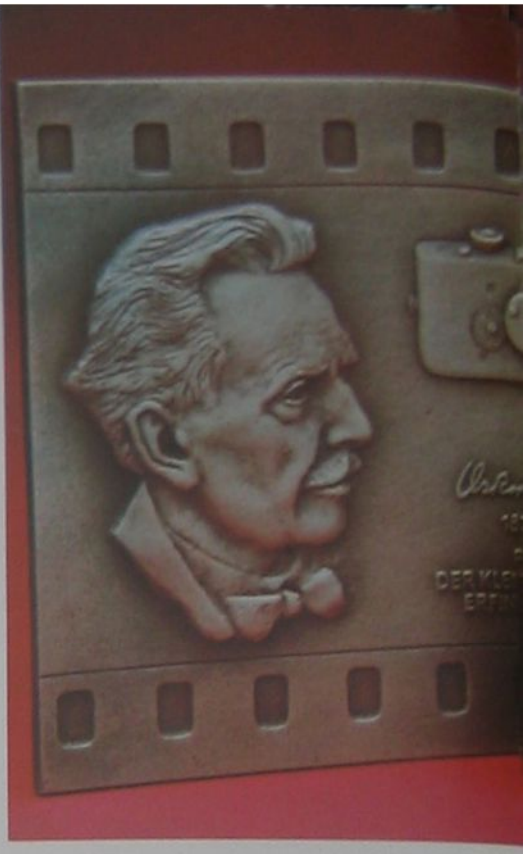
Since no members of the public are allowed inside the ring, Sergio took all his shots from the front rows of the audience, pointing out that professionals have no advantage regarding positioning over the amateur.

Clown *To make use of the rich colours of the natural light, Sergio asked this performer to pose outside. 35 mm lens, 1/30 second at f/1.4 on Kodachrome 25.* **Make-up** *Obtaining permission to photograph behind the scenes allowed Sergio shots like this. 105 mm lens, 1/60 second at f/5.6, Kodachrome and Braun 910 flashgun.* **Tight rope** *Since the performer was a fair distance away, the film was uprated from 200 to 400 ASA/ISO to avoid having to use a powerful flash. For shots like this, Sergio had to be careful to avoid the large numbers of nets and ropes, hanging from above, from obstructing his view.* **Tigers** *Keeping a safe distance to avoid disturbing the animals, Sergio used a 28 mm lens to frame the tigers in their cage.* **Big Top** *A 16 mm full frame fisheye was used to take in the entire scene.* **Elephant** *By finding out the elephants' bath time Sergio managed this amusing shot. 28 mm lens*



Collectors' cameras

Collecting old cameras is a fascinating hobby. But there are hundreds of old cameras available, so it is useful to know which are worthwhile buying



One of the most interesting aspects of the development of photography is the progress of equipment design. So it is not surprising that collecting old cameras has become very popular. Of all the different types of equipment produced over the years, the most popular with collectors are the early small format (generally 35 mm) cameras as the majority are quite common and can still be used.

At the Leipzig Spring Fair in 1925, an old established microscope manufacturer, Ernst Leitz, launched a camera which was to revolutionize photography—the original Model A Leica. Although there had been several earlier 35 mm cameras, it was the Leica's precision, handiness and versatility which effectively began the trend towards 35 mm photography. Design followed design, with coupled rangefinders appearing in 1932, and the first reflexes in 1935.

In the headlong rush of improvements, no-one cared very much about old cameras. It was not until the end of the 1960s that a few people began collecting, and an interest in old cameras ceased to be regarded as an eccentricity. They fell into two camps at first—those who were collecting recognizably 'antique' cameras and the Leica collectors, who were going back to the roots of 35 mm. Slowly, other cameras became 'collectable' such as the Leica's great rival, the Contax, and other masterpieces of German precision.

Soon, people began to realize that the great Japanese firms had an impressive lineage too—the Canon rangefinders, (from 1934–1967 approximately), and the Nikon rangefinders (from 1948 to about 1963) for instance. There was also a growing interest in unusual and limited-production cameras such as the single-shot Leica, or the tiny view-camera K1 Monobar 35 mm. By the 1970s it was a standing joke that if a camera was no use for anything else, the dealer would label it 'collectable' and multiply the price by ten. While prices have shown considerable variations, camera collecting is now firmly established and prices are fairly stable.

There are many reasons why people collect old cameras. Some are simply fascinated by their craftsmanship and the ingenious solutions to what is essentially the same problem, as well as the process of tracing the evolution of today's cameras from those of the past. Other collectors like to *use* old cameras. While some are tricky to use, with their scale-focusing lenses and separately cocked Compur shutters, others offer features rarely or never found on current models. The Robot's spring drive and the range of lenses of the Nikon SP (unmatched even by Leitz) are examples. Furthermore, vintage cameras have a unique feel. Many are amazingly compact, and the quality of the better ones is not encountered outside Leicas, Hasselblads, and very few other traditionally built cameras today.

Early SLR *The 1936 Kine Exakta was the first practical 35 mm SLR camera. It offered shutter speeds from 12 seconds to 1/1000 sec, interchangeable bayonet mount lenses and built-in flash synchronization*

Some collectors 'invest' in old cameras. While buying and selling antique cameras can be profitable, it requires a good knowledge of the market as well as of cameras. There was a time when collectable cameras were rising quickly in price, but now the investment market deals mainly in extremely rare items, with a few staples such as gold-plated Leicas, 250-exposure Leicas, and wet-plate cameras.

While you can spend a great deal of money on camera collecting, you can also buy interesting and usable cameras which are extremely cheap. Surprisingly, the best place to look for bargains is a large photographic store—geared to selling new cameras and the commoner second-hand equipment, they are unlikely to recognize classics from the past. You can sometimes buy cameras for a fraction of what you would pay in a specialized antique-camera shop. Moreover, for most people the attraction of camera collecting is hunting out what they want. While you are more likely to

Top models *The Leica Model I (left), also known as the Model A, is shown with a plaque featuring the designer Oskar Barnack and the 1914 Leica UR prototype. Above is the 1935 Leica 250 which used special film cassettes but was similar in other ways to the III and IIIa models*

find this at a specialist dealer, it can be less exciting than searching for yourself. Junk shops and antique shops come up with the occasional bargain, but this is rare. Their prices are high, so the only bargain here is likely to be something *really* rare which is worth even more than its high price!

If you want to specialize in a given area of camera collecting, there are many ways of doing so. Some collectors specialize in one make—Leica, for instance—or you can collect only cameras from one country, or only automatics (a very under-collected field), or only 35 mm folding cameras and so on. For simplicity, we can say there are five categories of 'collectable' (or at least collected) cameras.

First, there are the accepted classics. The best known is the Leica, with its innumerable accessories and variations. The vast majority of Leicas are usable. They are also almost indestructible and most breakdowns can be repaired. The cheaper models and their lenses—the IIIa, IIIb, and IIIc with 50 mm, 90 mm, 135 mm, and (to a lesser extent) 35 mm lenses—are reasonably priced, at around the same price as a cheap modern SLR. Outside the range, though, prices can climb rapidly. A Compur-shuttered Model B could fetch as much as a new Hasselblad outfit and a motorized Luftwaffen issue 250 could be exchanged for a good car.

However, Leicas are not the only classic cameras available. Contaxes although hard to repair and awkward to use, are beautifully made and offer an enormous range of accessories. The black Contax I (introduced in 1932) is the most sought after, but is not very usable or reliable. The postwar IIa and IIIa come next, being both usable and quite reliable, while the intermediate II and III (introduced 1936) are sometimes quite cheap. Contaxes and most Zeiss prewar 35s can be a problem if they break down—repairs are not always possible. Because of their quality and their eccentricity of design, most prewar Zeiss miniatures are widely sought after.

The Nikon and Canon rangefinders are both highly regarded. The most desirable are the first models—the 1934 Canon has a unique bayonet fitting, while the post 1942 model has a Leica thread, while the 1948 Nikon Mod. 1 has a 24 × 32 mm format. The last models

Mercury Univex *This 1938 half-frame camera is collectable rather than usable. Its main features include a rotary shutter, special film cassettes, and built-in hot shoe flash mounting*

Voigtländer Vitrona *This camera was years ahead of its time with its automatic exposure and built-in electronic flash. The handle contained the power for the flash unit*

Colin Glanfield/Cameras courtesy of Paul-Henry Van Hasbroeck and Vintage Cameras Ltd.

Leica alternatives *The Leica Compur (above left), also known as the model B, is a 1929 lower priced option to the model I (right). Only 1500 model Bs were produced so it has become a much sought after collectors' item*

are also sought after, because they are the most usable (Canon 7 and 7s, Nikon S3, SP, S4).

The second category might be called the underrated classics. These include the German Kodak (Nagel) factory, and Otto Berning. Kodak made the lovely folding Retinas, of which the only highly priced ones are the last models—the IIc, IIIc (1954/7) and the IIC/IIIC (1958–60). 'Big C' models had brightline finders and more sophisticated meters. There are few accessories for earlier models, but for the c/C series there are interchangeable 35 mm and 80 mm lens components, stereo beamsplitters, close-up attachments and much more.

Since 1934, Otto Berning has made the very expensive Robot from top-quality materials—the bodies, for example, were always machined from a block of stainless steel. Although new Robots are considerably more expensive than new Leicas, the scale-focusing 24 × 24 mm models (still available new) are often very cheap, even with top quality lenses. The only drawback, apart from the format, is the need to load special take-up and (for older models) feed cassettes. These are still available new, but can be expensive.

Robot cameras *Introduced in 1935, these cameras feature clockwork film/shutter wind giving 24 × 24 mm pictures at a rate of one a second. The 'long wind' Luftwaffen model II was used primarily for instrument recording*

Other neglected classics are the excellent Leica copies such as the British Reid and the Japanese Nicca, mostly dating from the 1950s, and individual cameras from a vast range of manufacturers such as the German Steinheil Casca. Konica's beautiful IIIA has not only moving-brightline parallax compensation but also moving-brightline field of view compensation for close focusing. The Voigtländer Prominent is an underrated if eccentric camera with a superb (if restricted) range of lenses, and their Vitessa is also very good.

The third category consists of those cameras which are perfectly usable, but not highly prized by collectors. The vast majority of these are German, and date from the 1950s. Zeiss, Voigtländer, and other top-flight firms made very worthy but somewhat dull cameras. Others, like the Agfa Ambi Silette, can almost be termed 'underrated classics', though the rest of the Silettes were fairly undistinguished. These cameras are still available very cheaply, they usually give very good picture quality and they are likely to become collectors' items in time—though the collector market is unpredictable.

The fourth category is the rarities and unusual or technically interesting cameras. While some of these are very expensive, others are amazingly cheap. The Bell and Howell Foton, for example, can cost more than a new Nikon F3, but the Durst Automatica, a fascinating early (late 1950s) automatic camera with a *pneumatically controlled* shutter–light meter coupling rarely costs more than three or four rolls of Kodachrome. Other expensive varieties include pre-Leica 35 mm cameras: the Spektaretta tri-colour camera (1939), with three frames per exposure and a beamsplitter; the Hologon Ultrawide, with its fixed 15 mm *f*/8 lens (c. 1968); and the magazine-loaded Adox 300. Cheaper ones include the almost wilfully eccentric Periflex (1953), with a tiny reflex mirror which slides periscope-fashion down into the dark chamber; the white-enamelled Ilford Advocate (1950); the Voigtländer Vitrona with built-in electronic flash; and

Kodak Retinas *These are the first and last models of this much loved folding camera. The black model I dates from 1935 while the 'big window' IIc is of 1958 vintage. Both are still usable and give good results*

Classic Contaxes *Twenty years of development separates the famous Contax I from its chrome IIa relative. Both are still capable of producing fine pictures, especially with the coated f/1.5 Sonnar lens*

Colin Glanfield

External condition

Always check to see if there are any parts visibly missing or broken. Look out for cracked eyepieces, viewfinders, meter glasses, etc.: sawn-off or broken strap lugs, missing winding knobs or shutter speed dials: missing body covering. If the camera is rare enough, these may not matter, but otherwise only buy the camera for spares or if you already have another from which you can take the spares. The only exception to this is body covering, which can usually be replaced.

Examine the camera carefully for signs of damage and deterioration. Verdigris—the green stain on brass or copper—can be removed with petrol or alcohol, and metal polish works wonders on chrome. Body covers can be replaced, or cleaned with boot polish on a toothbrush. Worn black paint, or scratched chrome, is very hard to replace. Once-chrome screws, now rusty, can usually be replaced with something from the scrap box. Turned over heads (turn slots) indicate that someone unskilled has attempted to get inside the camera, and may well have succeeded.

Look for alterations and replacements such as modified flash synchronization and later lens coating. These can only be checked if you know the camera, and even then there are always surprise factory-fitted variations. Factory variations increase value—others detract from it.

Mechanical

Make sure all the controls and mechanisms work smoothly. Controls include wind-on, shutter-cocking (if separate), focusing, diaphragm and lens changing. Mechanisms include shutter, film advance (some cameras only work with film in), rangefinder (if accurate at infinity is usually accurate elsewhere), flash synchronization meter and self-timer. Some problems can be solved by cleaning and lubrication—for example, sticky shutter speeds, self timers, shutter release—but jammed mechanisms are more of a risk.

With the back off, check the bellows for pinholes against a strong light. Check that all scales agree with what is actually happening, e.g. aperture/diaphragm ring, distance scale/rangefinder, shutter speed dial/shutter speed. Note that some cameras only indicate the correct speed when the shutter is cocked.

Optical

Check both lenses and viewfinders to make sure they are unscratched and clean—use a blower brush, lens tissue, and Kodak lens cleaning fluid if not. Also look for any dirt inside. Most rangefinders can be cleaned easily, but lenses are expensive to clean and may be damaged. Beware of grease evaporated on to inner elements from the diaphragm lubrication. Look out for dented filter mounts. If fitted, check the parallax compensation mechanism in the viewfinder and the selector mechanism for different viewfinder fields.

Business

Check about a guarantee. If the camera is very rare, you may be prepared to forego the guarantee, and in any case, the camera may not be repairable. You might prefer to keep the carcass rather than have your money back. Try to get a reduction for doing without a guarantee. Always negotiate, and try to get extras (such as filters, and so on) 'thrown in'. Most 'collectable' cameras are priced to allow a certain amount of haggling, usually between 10 to 20 per cent off.

the Agfa Selecta-M, with built-in, very slow electric film advance (c. 1962).

Last, there are 'junk' cameras, of no value to collectors, but interesting nevertheless. You can collect them for the fascination of their poor design, poor engineering, bad quality lenses, awkward handling, poor materials, unreliability and so on. Each camera need only cost the same as a roll of Kodachrome, and it is fascinating to see how many wrong ways there are of doing things.

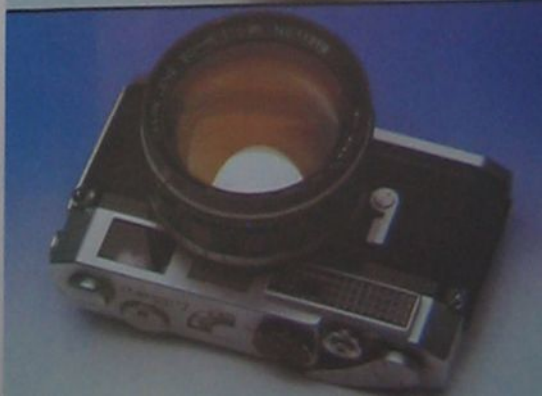
Whatever category of cameras you choose to collect, there are a number of ways of increasing your enjoyment. The easiest is to look at contemporary literature—catalogues, books, magazines, and yearbooks—in which equipment may be reviewed. You can have a great deal of fun dating cameras.

More effort, but possibly more rewarding, is to join a collectors' club: most of these operate on a postal basis, with a newsletter and occasional meetings, because of the far-flung membership. You can go to 'swap-meets', too, both for the pleasure of the trading and the chance of meeting fellow fanatics. To help you value your treasures, there are several modern catalogues which illustrate old cameras and give a very rough idea of their value: if nothing else, these are useful for identification.

Because of the vast diversity of cameras available, it is useless to attempt to name more than a few, or to describe what to look out for in individual models. You can collect cameras in three types of condition: non-functioning, functioning but obviously used, or pristine and in working order. The price differential is likely to be in the ratio 1:2:3, or even 1:2:4 for highly sought-after cameras like the Leica MP.

It is advisable to look a camera over carefully before you buy it, especially if you want to use it. There are many points to look out for, and it is surprising how much you can tell about the camera's condition from the outside. If you do not plan to use your old cameras, mechanical condition is less important—but the better the state of the camera, the greater its value as a collector's item.

Unusual items *The 1953 Ilford Advocate featured a cream stove enamelled finish and was equipped with a 35 mm wide angle lens as standard. The 1960s Canon 'Dream' (bottom) was fitted with an incredible f/0.95 lens, the fastest ever fitted to a still camera. Its only drawback was very small depth of field at distances under three metres*



Understanding...

Shutter efficiency

For correct exposure it is important that the shutter operates efficiently. But achieving precise exposure times is not as simple as it may seem, as no shutter mechanism is perfect

At one time the film in a camera was exposed simply by taking off and then replacing the lens cap. In the early days of photography exposures were so long—sometimes up to 30 minutes—that a few seconds more or less exposure made very little difference. But as films became faster, and exposure timing more critical, more accurate shutters were needed. However, sophisticated shutter mechanisms introduce special problems of their own.

In particular, the opening and closing of the shutter is never instantaneous and the time taken by these actions must be allowed for by the manufacturer when calculating shutter speeds. The two basic types of shutter—leaf and focal plane—are described on pages 84 to 85 and 110 to 111 but the differences between them are important.

Leaf shutters

With a leaf shutter the whole of the film area is exposed at once. Ideally, the shutter should open instantaneously and then, after the preset exposure time has elapsed, should close instantaneously.

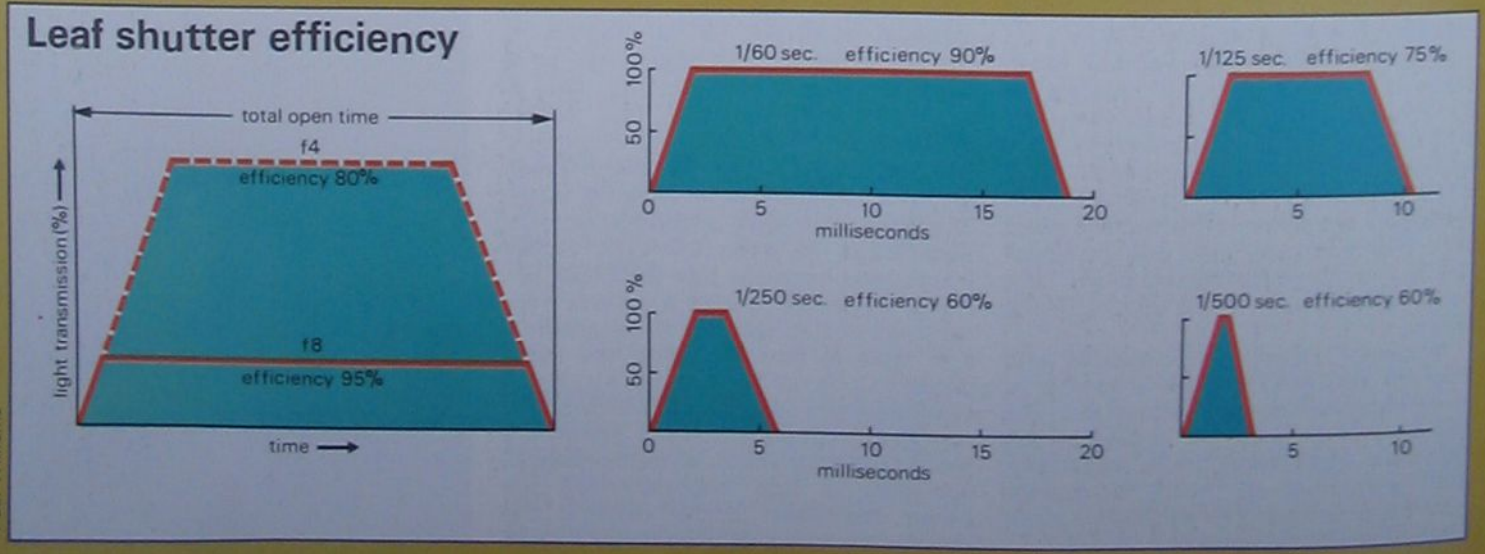
However it is physically impossible for even the most lightweight shutter blades to operate in zero time and, in practice, a shutter takes at least a millisecond to open and close. This means that the shutter is fully open for slightly less than the complete operating time, known as the *total open time*. While the shutter blades are moving, they act in a similar way to the lens aperture diaphragm so that the end result is that less light reaches the film than with the ideal theoretical shutter.

The amount of light actually reaching the film can be quoted as a percentage of the light which would reach the film if the shutter were perfect. This figure is a measure of the shutter's *efficiency*. The *effective exposure time* (the one marked on the shutter dial) is found by combining the total open time with the efficiency of the shutter. If, for example, the total open time of the shutter is 78 milliseconds (ms) and its efficiency is 85 per cent, then the effective exposure time

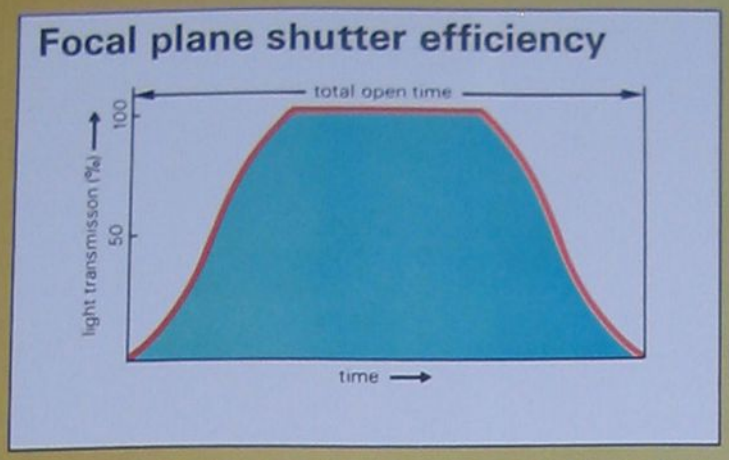
Mary Evans Picture Library

Simple shutter *Photographs used to be taken by removing and replacing the lens cap, the exposure being timed with a watch—perfectly adequate given the materials*

Leaf shutter exposures *The time taken for the shutter blades to open and close is a much larger portion of the total exposure at fast speeds than it is at slow ones*



Paul Williams



Paul Williams

Focal plane efficiency *The graph above shows the intensity of light reaching a point on the film as the shutter slit passes. The gradual build up and fall off is due to the shutter blinds not being in contact with the film plane. If they were (as in the ideal shutter below) each point on the film would be exposed to the entire cone of light from the lens at once. But with practical shutter designs the blinds intersect the cone with the result that it takes a short time for it to be completely uncovered*

is 85 per cent of 75 ms, which is 63.75 ms or around 1/15 second.

The effective exposure time is always shorter than the total open time. However with slow shutter speeds the efficiency is nearly 100 per cent, because the time taken for the shutter blades to open and close is insignificant compared with the total open time. The opposite is true with short exposures—particularly with the top speed of 1/500 second.

At these speeds the shutter closes almost immediately after opening. This means that a fairly large proportion of the total open time is taken up by the operation of the shutter blades. At the 1/500 second setting the shutter efficiency is often down to around 60 per cent.

As leaf shutters take about one millisecond to open and a similar time to close, even if the shutter is fully open for only a millisecond, the total open time is three milliseconds. At 67 per cent efficiency this gives an effective exposure time of around two milliseconds, or 1/500 second. This is why leaf shutters never have top speeds faster than this as shorter exposures would require impossibly fast shutter blades to cut down the total open time.

However, the shutter speed is not the only thing which affects efficiency. The aperture in use also has an effect. With a small stop the aperture is uncovered in a shorter time than with a large aperture. So the efficiency of the shutter is greater with small apertures.

Focal plane shutters

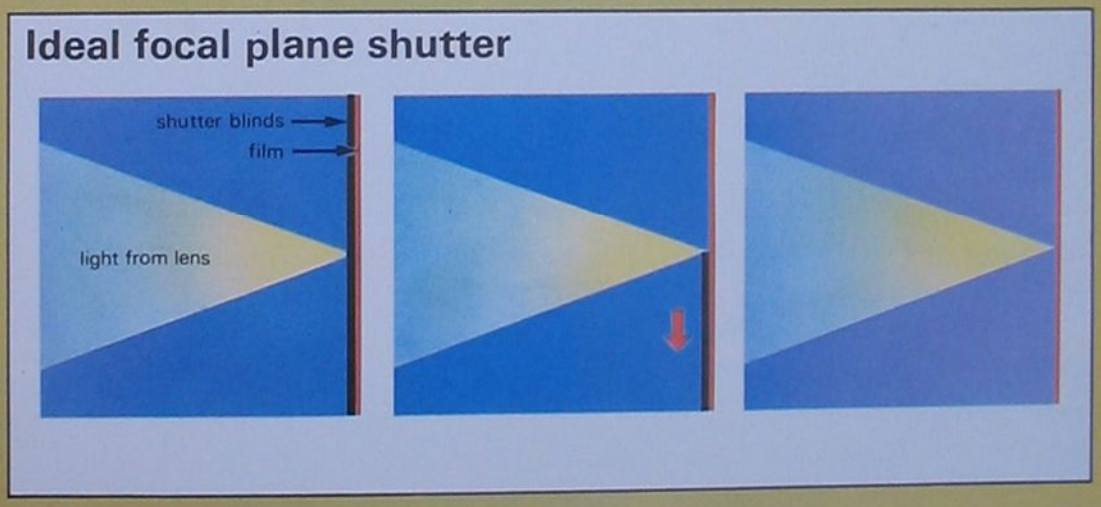
Focal plane shutters are, similarly to leaf shutters, more efficient at small apertures but other important factors are the size of the slit formed by the shutter blinds and the distance from them to the film plane.

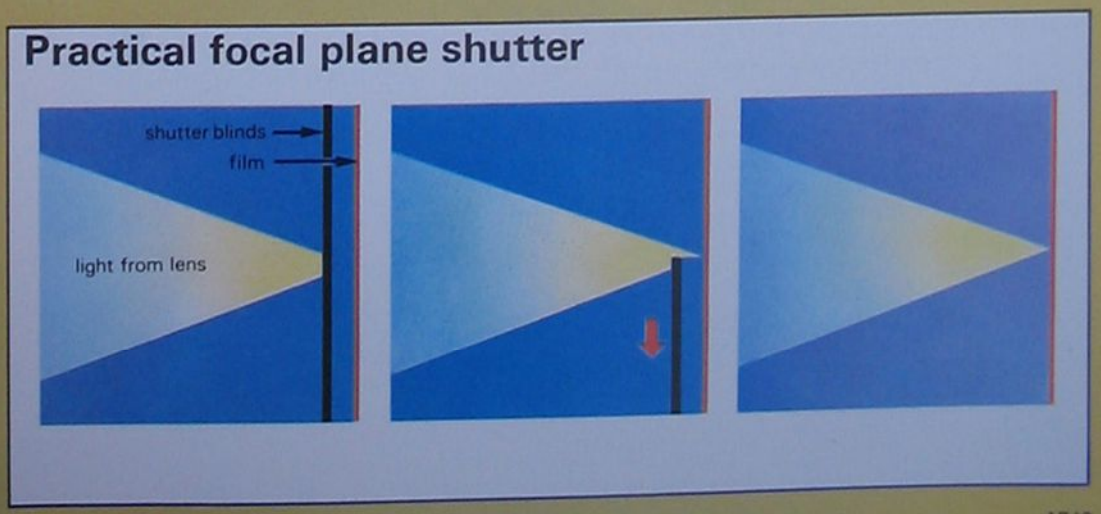
If the blinds were in contact with the film, the efficiency of the shutter would be 100 per cent at all speeds and apertures. This is because each point on the film would be instantaneously exposed to the whole lens aperture as it is uncovered by the shutter. But because of the small gap between film and shutter blinds, it takes time for all of the light from the aperture to reach the point on the film. For this reason manufacturers make this gap as small as possible.

As with leaf shutters, the efficiency is greatest with longer exposures. At 1/60 second the efficiency is often around 90 per cent. And also like leaf shutters the effective exposure time is shorter than the total open time.

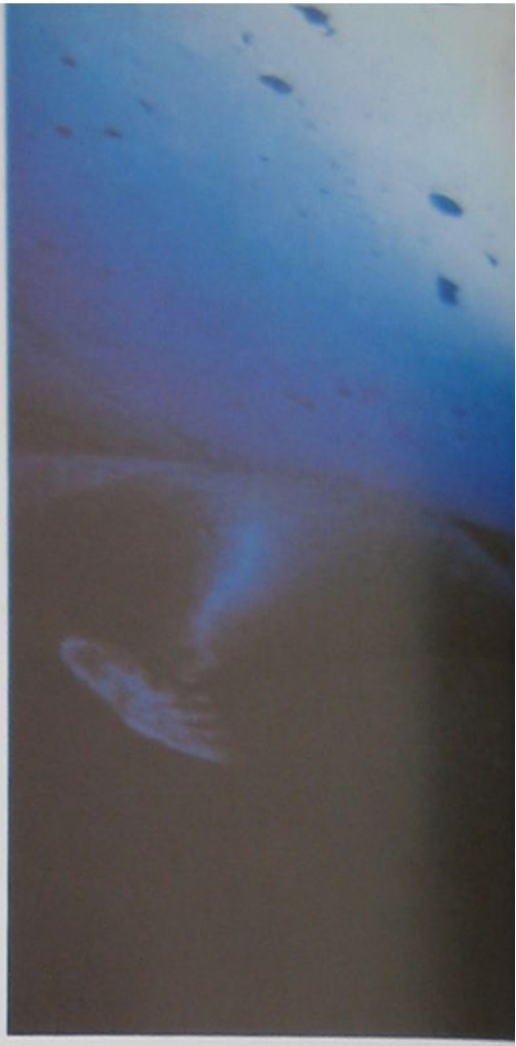
Shutter efficiency should not be confused with accuracy. The efficiency is connected with the design of the shutter whereas accuracy is concerned with practical mechanics. This means that the effective shutter speeds marked on the dial may not be exactly the same as the actual exposure given. For example, a shutter which is supposed to be giving a speed of 1/1000 second may only give 1/700. Even the best shutters may contain some inaccuracies, particularly under arduous conditions such as high humidity or extreme temperatures (see page 1205), and as the camera gets older the shutter mechanism often gets sluggish. The result is lower efficiency due to the shutter blinds travelling more slowly.

As long as these inaccuracies are kept within limits their effect on exposure is negligible. With focal plane shutters the exposure times given should not differ from the marked speeds by more than plus or minus 25 per cent for exposure times of 1/125 second and longer, and by plus or minus 33 per cent for exposure times shorter than 1/250 second. With leaf shutters the tolerances usually quoted are plus or minus 20 per cent for exposures of 1/100 second and longer, and plus or minus 30 per cent for speeds shorter than 1/100 second.





Paul Williams



Herbert Ponting/Popperfoto

Crabeater seals *Swimming under an ice floe at Signy Island, Antarctica. Doug Allan, a member of the British Antarctic Survey, took this with a Nikon F2 in an underwater housing. He used a 24 mm lens and flash at f/8.*
Ice cave, 1911 *Ponting's classic also shows Scott's ship, 'Terra Nova'.*
Nightfall *The silhouettes of distant mountains enhance this dramatic sunset*

POLAR PHOTOGRAPHY

The icy and dramatic wastes of the Arctic and Antarctic have inspired photographers to overcome some of the most severe physical conditions on earth

In the Arctic, temperatures often drop as low as —40°C; so cold that moisture from your breath turns to ice on a camera lens, and cold enough to freeze skin to metal instantly. And if it starts to snow heavily, it can blot out all features of the landscape and destroy all sense of distance and space in a 'white-out'. If you try to move around in such conditions, in no time you can become hopelessly, perhaps fatally, lost.

At such times, the Arctic and Antarctic hardly seem the most promising environment for a photographer, but when eventually the weather clears, the transformation is so breathtaking that despite the hazards and discomforts, these two places, literally the ends of the earth, have captivated photographers since the beginning of the century, from the pioneers of polar photography, Herbert Ponting and Frank Hurley, to modern grand masters such as Eliot Porter. The Antarctic in particular has also turned into avid photographers many of the scientists stationed at the permanent bases set up there after World War 2. More recently, ordinary tourists too have had the opportunity to briefly visit the perimeter of the ice-continent and to take home pictures of a lifetime.

The quality of the light is extraordinary and the clarity of the air makes using a telephoto lens a delight. Mountain ranges 300 km away appear barely 100 km off, and the lack of atmospheric haze gives distant scenes a crispness and a range of colours unique in the whole world.

Far from being desolate frosty wildernesses, the Arctic and Antarctic are the world's last great wildlife reserves. While much of the Arctic is sea, all of Greenland and large areas of Canada, the Soviet Union and Scandinavia lie within the Arctic Circle, and although covered by snow and shrouded in darkness for much of the year, the landscape bursts into life during the short summer as plants and animals alike make the most of the time available to breed and store up food for the next winter. The opportunities for natural history photographers are enormous and several species of animals and plants can be found nowhere else. Closer to the

Doug Allan

North Pole, on the permanent ice of the Arctic Ocean, life becomes scarcer, but even here several species of seal can be found the whole year round, diving down through their carefully maintained breathing holes in the ice to feed on the rich marine life below the pack. There are also solitary polar bears, the largest carnivores on land, ranging over huge distances in their hunt for food, covering up to 20 miles a day.

Being cut off from the rest of the world by hundreds of kilometres of turbulent ocean, and largely covered by perpetual ice, the continent of Antarctica is home only to animals that can live off the sea—seals, petrels, skuas, gulls, penguins. For photographers, one advantage of the continent's isolation is that most of the animals of the Antarctic are quite unafraid of humans and it is relatively easy to get in close to the subject for exciting, detailed shots that would require hours, even days, of patient observation from a hide if the photographer was working with more wary animals. Even so, it can be dangerous to get too close: more than one photographer has had to beat a hasty retreat when an enraged male sea-elephant mistook him for a rival for the attentions of his mate! Fortunately, they move too slowly to be much of a threat to someone carrying nothing more than a 35 mm camera and a bag of accessories. For the early polar photographers, it would

Geoff Renner/Robert Harding Associates

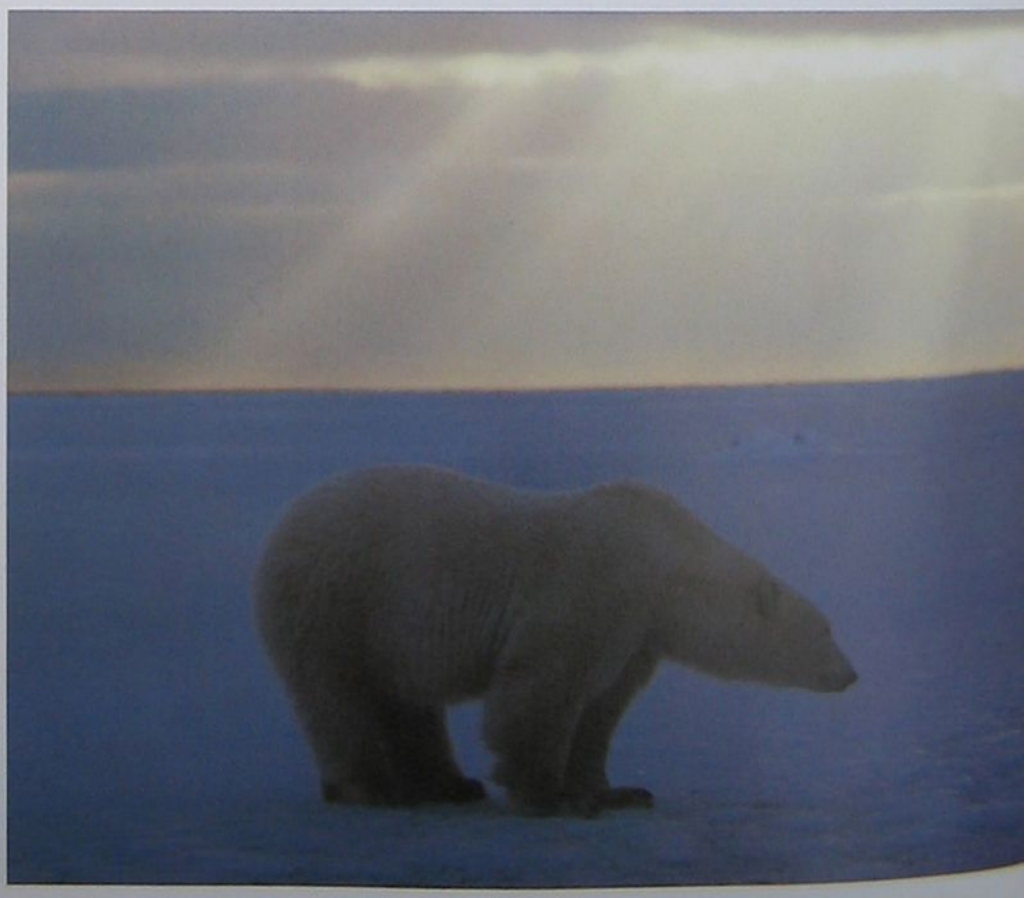
Cloudscape *Superb weather phenomena like these lenticular clouds can frequently be seen at the poles*

have been a different matter, weighed down as they generally were by a heavy view camera, sturdy wooden tripod and a case full of photographic plates.

Yet it was these pioneers who, well over half a century ago, brought the Antarctic, its beauty as well as its hardships, before the eyes of the world for the first time. Of these men, two in particular, stand out: Herbert George Ponting and Frank Hurley.

Although photographs had been taken on expeditions before, Ponting, who accompanied Captain Scott on the British Antarctic Expedition of 1910–1913 was the first man to be taken along specifically as a photographer. The expedition was intended not only to be the first to reach the South Pole, but also the first to carry out a thorough scientific survey of the Antarctic. From the outset, Scott realized how important photography would be to the expedition's success, if not on the icecap itself, at least back home in Britain. At that time, people had only the haziest notions of the real nature of the continent, so the educational and publicity value of both still photography and motion pictures would be enormous. Since Ponting could not accompany the team that would make the final assault on the Pole, one of his tasks was to teach photography to the five who went. In the event, all five perished on the return journey, their notes and photographs the only evidence of the terrible ordeal of that journey and of the bitter disappoint-

Polar bear *Photographed in the autumn while waiting for the ice to build up on the shores of the Hudson Bay*



Herbert Ponting/Popperfoto

Antarctic landscape *An early autochrome taken by Ponting during Scott's Antarctic expedition*

ment at being beaten to the Pole by the Norwegian team led by Amundsen.

Ponting's photographs have become such classics that it is easy to forget the tremendous difficulties that beset him in taking them. Although an established travel photographer, working in the Antarctic was a totally new experience for him, and he had to learn about all the technical problems of photography in a cold climate the hard way. He had already winterized his equipment with some special oil he had bought in Switzerland, but that too froze and Ponting had to strip down his cameras again and improvise a lubricant from graphite.

With a difference of up to 60°C between the temperature outside and inside the expedition's hut, he also learnt not to bring his cameras indoors or they would soon be dripping with condensation. For the same reason, the glass photographic plates for his 5 × 7 inch camera could only be brought inside if he was able to develop them immediately, otherwise they would be ruined by wave-like markings on the emulsion also caused by condensation.

The biggest problem was getting water for processing. There is, of course, no fresh water in the Antarctic, only ice and snow, so every day he had to go out and chop a bit of ice off a nearby glacier and then melt it over a stove before he could start work.

Ponting's technical difficulties were compounded by the physical hardships that he had to overcome. He was once nearly killed when he was taking photographs on ice while the expedition's ship *Terra Nova* was being unloaded. Ponting was taken unawares when a group of over-curious killer whales surfaced near him and then came for a closer look, cracking the ice around him as they advanced.

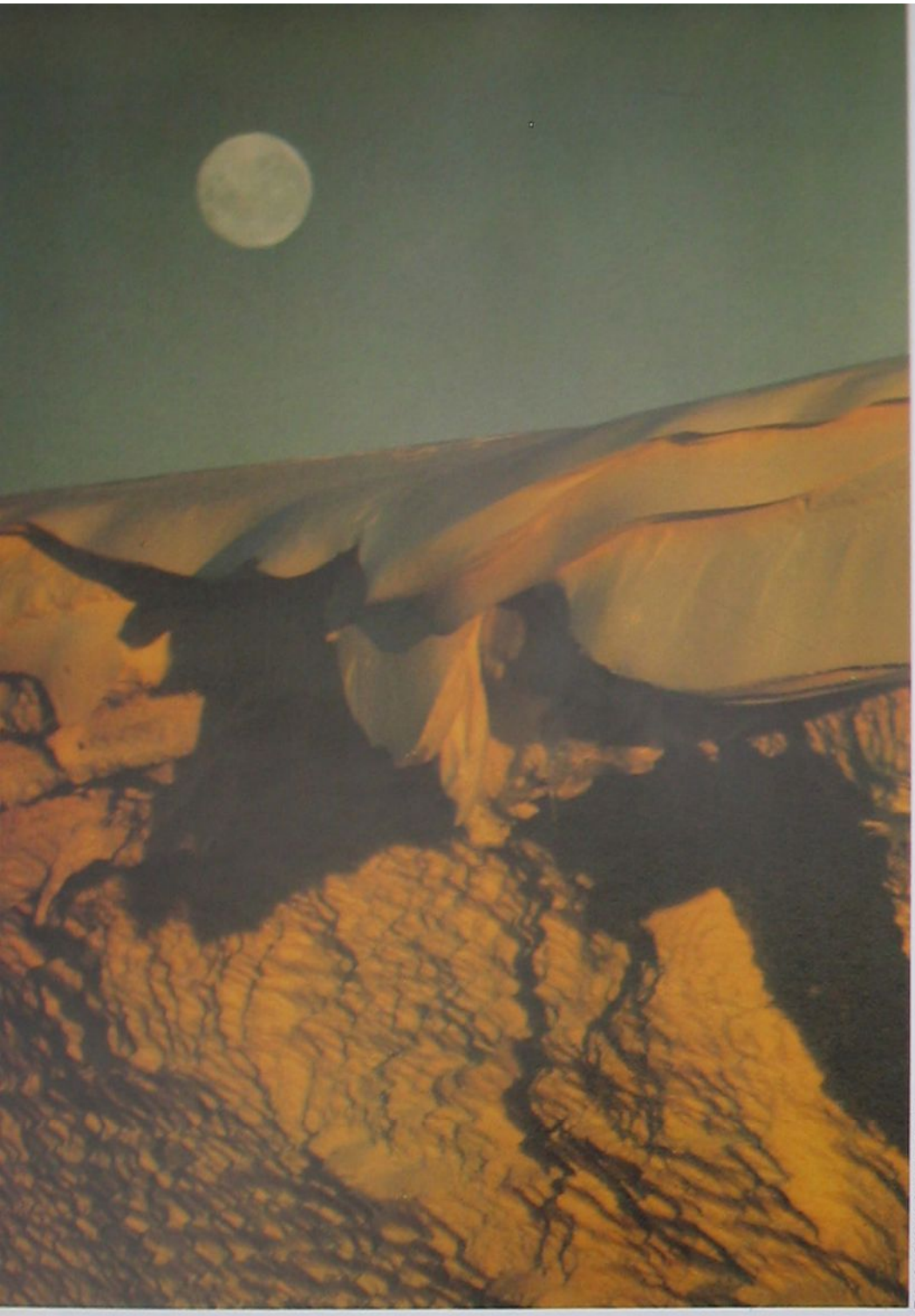
Despite being quite shaken by the experience, Ponting went back to work, photographing the dog-teams, almost immediately. Both then and now, an acceptance of danger and hardship had to be second nature to polar photographers. Whether fulltime professional or enthusiastic amateur, the photographer must be a part of a team, able and willing to share the same difficulties and discomforts as all the other team members, to do his fair share of the chores and be ready to turn his hand to any practical task. In short, a polar photographer, or any expedition photographer, must be tough, versatile and dependable. The toughest, most versatile and most dependable of them all was the Australian, Frank Hurley.

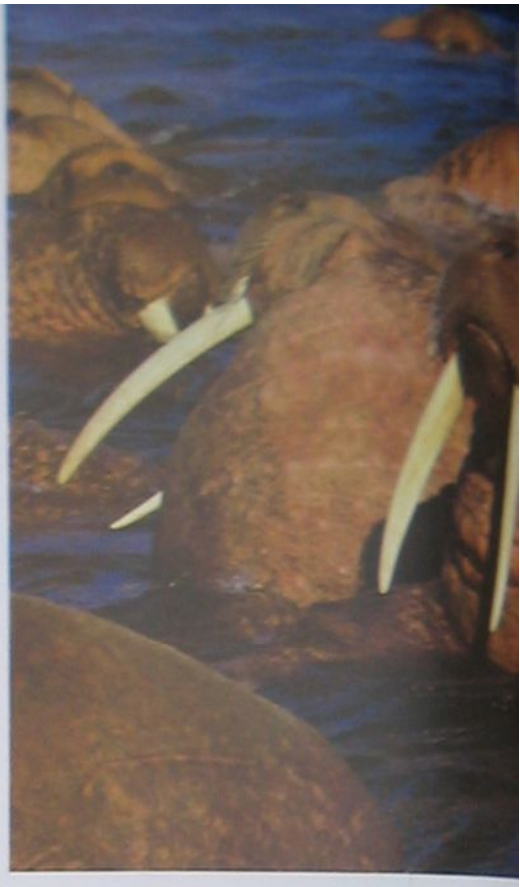
Hurley's first journey to the Antarctic was in 1911 with Australia's most renowned polar explorer, Douglas Mawson, but his best pictures were

Fred Bruemmer

John de Visser

Cape Dorset, *Baffin Island in the NW Territories. Traditional Inuit housing has been replaced by modern prefabs*





Edwin Mickleburgh/Ardea

Moon rise *These dramatic ice cliffs at Halley Bay in Antarctica are illuminated by the midnight sun*

made on his second visit, as photographer, cook and hunter for Ernest Shackleton's 1914–1916 Trans-Antarctic Expedition. During their first winter, their ship, the *Endurance*, became trapped in the ice and was eventually crushed by the tremendous pressure of the contracting pack. There then began one of the most gripping survival stories in polar history, during which not a single life was lost. Three long boats were saved from the wreck and with these, the crew endeavoured to fight their way back to the whaling stations of South Georgia, the nearest place of help.

At first, Shackleton had insisted that all Hurley's equipment be thrown overboard to save weight, but Hurley eventually persuaded him to allow him to keep the cine film he had already shot together with a few still pictures. He was also allowed to take one small camera and three rolls of film to record the return journey.

When at last they arrived in London in 1917, they learnt that without some wildlife footage, their film of the expedition was not marketable. Shackleton had been counting on the royalties from the film to pay off part of the costs of the expedition, so Hurley immediately returned to the Antarctic, filmed all the missing scenes and edited them into the original footage. The finished film, *In the Grip of the Polar Ice* made a small fortune, saved Shackleton from bankruptcy and secured Hurley's reputation as the most fearless and resourceful cameraman of his time.

At the same time, in the period following the end of World War 1, the pattern of polar exploration also began to change. The prime goal, to get to the Poles, had been achieved; Robert Peary reached the North Pole in 1909 and Raoul Amundsen the South in 1911 and, in doing so, deprived other potential explorers of much of the impetus and the possibility of glory that made the hardships seem worthwhile.

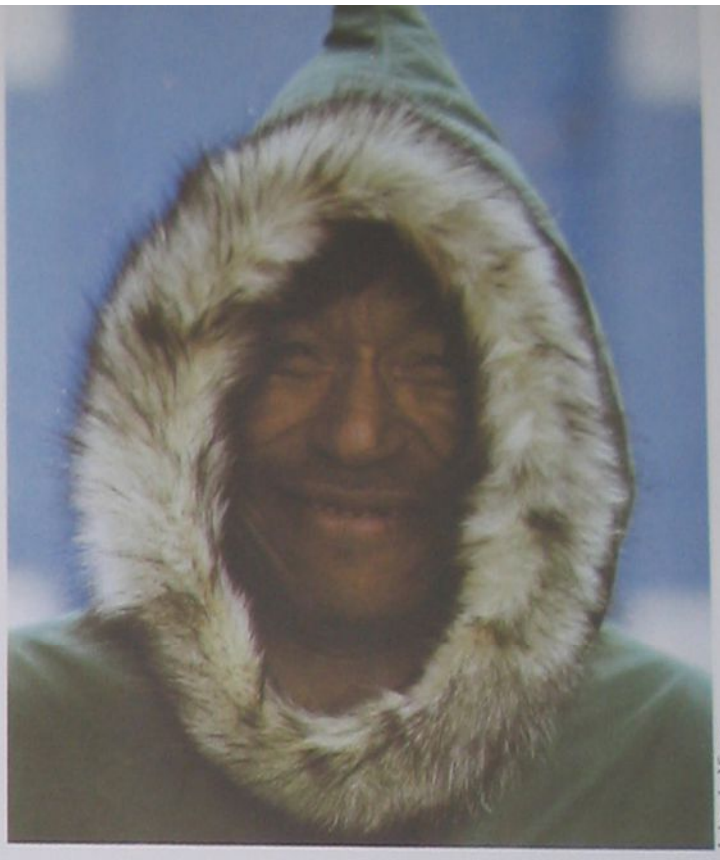
Nevertheless, although the Poles had been reached, most of the Arctic and Antarctic remained unexplored and uncharted. During the 1920s and 1930s, surveying these vast empty spaces became the main preoccupation of polar explorers and scientists, and to do so, they turned to the new marvel of that age: the aeroplane. On May 9 1926, the American, Richard Byrd, took off from Spitzbergen, made the first flight to the North Pole and returned safely to Spitzbergen. Three days later, Amundsen and the Italian, Umberto Nobile, flew the airship *Norge* right over the polar cap, from Spitzbergen to Alaska. Then in 1929, Byrd made the first flight to the South Pole as well.

Once it had been proved that flying over the poles was essentially no more difficult than flying anywhere else, the way was open for large scale survey work using aerial photography.

This new approach to polar exploration called for a different type of explorer and a different style of polar photography. Scott and Shackleton were at heart enthusiastic and enterprising amateurs, and their photographers, Ponting and Hurley, were what would now be called editorial photographers; their interests and skills were in making photographic stories about people, places and experiences. After 1918, though, and even more so after 1945,

Fred Bruemmer

Walruses *at Round Island, Alaska. Bruemmer waded into the water with his 135 mm lens to capture this close-up*



John de Visser

The face of the Arctic *Harsh conditions have etched deep lines in the face of this cheery Inuit character*

Ice sculpture *Ice and snow are often shaped into fantastic shapes by the extreme weather conditions*

Edwin Mickleburgh/Ardea

Eliot Porter

Jade iceberg *Porter shot this iceberg, coloured by algae and plankton, off Livingstone Island, Antarctica*

the polar regions were seen not as testing grounds for human endeavour, but as scientific laboratories, as potential sources of minerals and petroleum, or as important strategic bases.

Although polar photography has benefited from the vast improvements in cameras and film over the years, the problems today are more or less the same as those that faced the pioneers. The advantages of lighter and more reliable equipment must be set against the hazards of 35 mm film becoming brittle and snapping in the cold or against the fact that to function, many modern cameras need batteries whose power is rapidly drained in extremely low temperatures.

One great advantage of modern gear is that it is so easy to learn how to use it that no professional photographers have needed to be employed at the permanent scientific bases set up in Antarctica since 1945. Although photography is used extensively there as part of the various programmes of research, it is carried out by the scientists themselves.

Professional photographic assignments to the polar regions are uncommon, but publishers, television companies and scientific bodies do occasionally commission professionals to work there on special projects. Some of the finest recent photographs of the Antarctic came out of an assignment offered by the American National Science Foundation in 1974 to Dr Eliot Porter.

The organization, research and preplanning on such an assignment has to be even more meticulous than usual. All equipment must be carefully overhauled and tested, and all contingencies allowed for, since breakdowns and oversights cannot be corrected later. Good weather at the poles is rare and the distances between locations can be huge, so a thorough checklist of everything to be photographed must be prepared in advance together with notes on the best time of year for photographing each item and an itinerary and timetable to enable the photographer to travel from location to location as conveniently as possible. Except for short distances, most journeys in the Antarctic are now carried out either by helicopter or light plane, but flying time is expensive and strictly rationed, and Eliot Porter was allowed only ten hours in the air during his entire stay. Knowing where and when he needed to be for a particular shot was essential.

Rare among modern polar photographers, Dr Porter used a large format camera, a 4 × 5 Linhof, believing that the advantages of definition and perspective control override the disadvantages of weight and bulk, and that the unique beauty of the Antarctic landscape of mountains, dry valleys, glaciers and ice-caves fully justified the slow, considered approach of large format work.

For the unsponsored amateur, photography in the Arctic and Antarctic presents two big problems: getting there and staying there. Unless you are able to fund your own expedition—which could be excessively expensive—the only way to reach the Antarctic is on one of the tourist boats that skirt its perimeter during the summer months. Although you are only given a few hours on shore, there is still plenty to see and photograph from the boat.

The Arctic Circle is in many ways easier to penetrate. Large parts of Canada, Alaska and Scandinavia lie inside the circle. In Scandinavia, this area is sometimes known as Lapland, although it crosses the borders of Norway, Sweden and Finland, for this is the traditional home of the Lapps. Once a semi-nomadic people, following the migrations of herds of half-domesticated reindeer for their livelihood, many Lapps now live a simpler and more frugal version of the comfortable urban existence enjoyed by Scandinavians.

Despite their superficial taming by science and tourism, the polar worlds remain enigmatic and present a very real element of danger that can still draw rugged individualists who wish to test themselves against some of the greatest hardships nature can present mankind. One such is the Japanese adventurer Naomi Uemura, who in 1978 made the first solo assault on the North Pole, an 800 km slog from the northern tip of Ellesmere Island with one large heavy sledge and a single team of dogs.

Modern still camera equipment is light enough not to make a major difference to the loading of a sledge, but being completely alone in the Arctic made photography a particular problem for Uemura. It was not simply that he had to place great reliance on the camera's self-timer so that he remained free to provide the human interest and scale necessary to many of the shots, it was also a matter of finding sufficient time to take photographs in addition to the many other tasks that make up the polar explorer's day. On one occasion, he paused to take some pictures only to find that the ice bridge on to the next part of the pack had meanwhile disappeared and the two floes were now separated by several metres of water. Finding a new route cost Uemura hours of delay and wasted effort; for the rest of that day, he roundly cursed everything to do with photography!

Uemura is one of the last of the old style adventurer-explorers. The changing nature of human involvement in the polar worlds means that whether they will remain photogenic paradises much longer is debatable. The Arctic has already been badly mauled by modern technology. The old, self-sufficient life style of the Inuit (Eskimo) has been disrupted; the people that were once the hardiest hunters in the world now survive listlessly on welfare handouts. Debris from oil rigs and mining operations litter the Arctic circle, while excessive hunting has seriously diminished the wildlife populations at both ends of the world, and for the first time air and water pollution is beginning to put a further strain on the already delicate ecological balance.

What went wrong?

On the downs

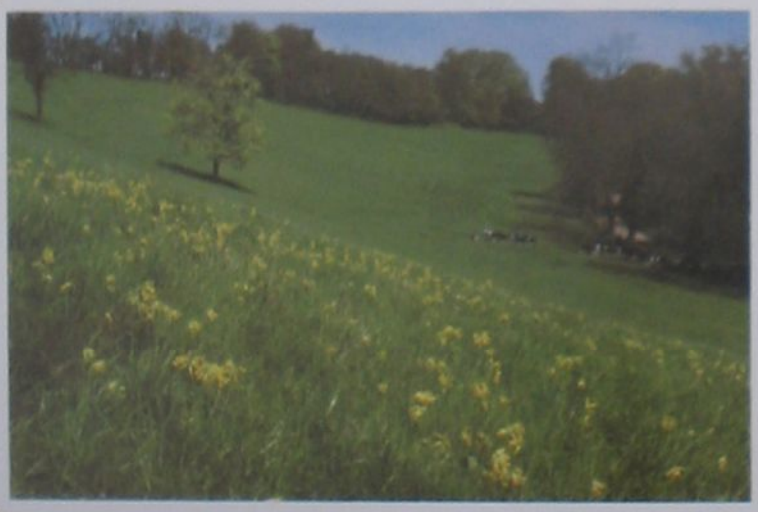
Sergio Dorantes looks at a set of pictures taken on rolling grassland and gives his critical assessment of their merits and faults

This photograph shows a very effective composition—the path leads the eye into the picture and helps to provide a focus of attention. This is one of the safest ways to hold the attention of the viewer. But despite this, there are a few faults with this image. The figure walking up the path is particularly small in the frame and thus fails to give a sense of scale since it appears as little more than a white blob, and the idea is lost.

By increasing the size of the person the effect of scale could be retained but the result would be more visual and interesting. This could be achieved by changing to a longer focal length or by waiting for the subject to move closer to the camera. The result would then be more homogeneous and precise, though if the figure became very large it would begin to dominate the picture, changing the emphasis.

The colour saturation is good, but the sky is washed out; it could simply be excluded from the picture or else minimized by using only a small strip.

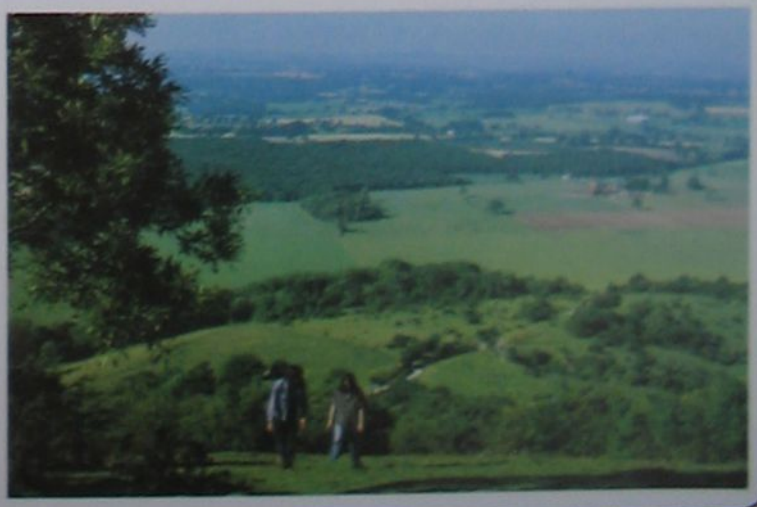
The picture was taken on the English South Downs.



This landscape shows an obvious fault: the foreground is sharp and the background is not. Generally, landscapes are better portrayed with the background sharper than the foreground, which serves to lead the eye slowly from the front to the back of the picture.

In this case, the photographer intended to show the wild flowers, cowslips, in their context. However, this does not come across well—the intention is not clear. The photographer should concentrate on one focal point which will anchor the attention of the viewer. In this example there are too many elements in the background for the idea to come across successfully.

On days with plenty of sunlight, as in this example, it is easy to set the lens at its hyperfocal distance to keep most of the picture clear and sharp. To achieve this with slow Kodachrome film, used here, a tripod may be necessary. Another approach would be to use a wide angle lens, which would help in giving wide depth of field and would give greater prominence to the closest flowers if used low down.



The tree branches in the top left corner have been used by the photographer to create a three-dimensional structure in the picture which is in most cases useful when photographing landscapes. Nevertheless, this picture fails as there is no strong focal point on which the eye can come to rest.

The overall sharpness of the image makes the idea of the picture confusing, as the eye tends to examine the horizon, the farm and the cattle in the middle of the picture, and the couple with equal attention. As a picture of the view it is spoilt by the couple; as a picture of the couple it is spoilt by the view.

If the photographer's intention was to portray the two people in this environment, it would have been better to wait until they were looking at the camera, as in this picture their heads are masses of hair. And there should have been more care in the background to their heads—with the enormous depth of field, bushes seem to be growing from their heads. Candid shots often fail for this reason.

The Colorvir process

A unique method of toning, the Colorvir process enables you to tone selective areas of an image to gain a wide variety of effects that cannot be achieved in any other way

At about the price of a hundred sheets of A4 black and white printing paper, the cost of the Colorvir toning kit may seem rather high, but in fact it contains almost everything you need to produce an extraordinary range of colour effects on black and white prints or film. The colour permutations and effects can be spectacular and are infinitely variable.

As with any other toning method, you begin by making a basic print which is developed, fixed and rinsed. This is then immersed in various baths of chemicals to tone the image. The advantage of Colorvir, however, is that different densities of the print can be toned in different colours. For example, a landscape with a light sky would tone with the sky blue and any darker areas yellow-green.

The Colorvir process—also known as the Jaffeux process, after its creator—consists of toners, additives, dyes and special effects chemicals, comprising a dozen liquids in the complete kit (see panel). Additional chemicals such as salt (sodium chloride) and acetic acid are necessary to get the most out of the kit. Sodium carbonate, sodium thiosulphate and a supply of used developer are all useful for secondary techniques.

The only equipment required for Colorvir work is plenty of dishes—up to eight, in fact. Most of the techniques involve transferring a print from one bath to, in turn, several others, but in varying permutations. It helps if these solutions are ready in dishes and laid out in a logical order. You will also need plenty of storage bottles—mainly for the colour dyes which can be reused over long periods.

Colorvir components can stain skin and clothing so it is very important to use print tongs, gloves and protective clothing. All the toning work can be done in normal lighting so choose somewhere that is well lit and well ventilated but with a room temperature of between 15°C and 25°C. Running water is useful for intermediate and final washes, but as the manufacturers suggest that hard water be avoided, you may get better results using dishes of distilled or demineralized water.

Your original print

The characteristics of the print you tone or colour have a direct bearing on the success or failure of the Colorvir process. Best results are obtained from prints which have a full scale of tones and, if anything, slightly soft gradation or low contrast. High contrast and line work cannot be successfully worked with.

The basic print should be developed in standard paper developer—not speed increasing types such as Ilfospeed or Multigrade—for not more than the normal 2 to 2½ minute time at 20°C. Underdevelopment results in blotchy, insipid colours, whereas overdevelopment may prevent Colorvir from working at all. Fix prints normally and make sure the print is properly washed afterwards—but do not leave the print to soak for too long.

Although virtually any type of black and white sensitized material, film or paper, can be treated in Colorvir, best results are obtained from RC print material. If you are toning film, the solutions must be used at four times their normal strength. The best materials to use are high contrast films such as lith film and underexposed slow panchromatic negative film. But individual characteristics of the various makes and types of emulsion can greatly influence the effects you obtain.

The toning kit

The toning kit consists of three solutions and a packet of sodium chloride (common salt) which is used to make a vital stabilizing bath for this and other parts of the Colorvir process. A by-product of the toning process is a yellow fog

The original black and white print

The print has been immersed in a solution of B:2.5 ml + C:2.5 ml + D:2.5 ml to 500 ml of water. This is followed by a three minute wash in a 30g/litre salt solution, and a three minute wash under running water

Pour in a solution of blue polychromic dye (100 ml of dye, 25 ml acetic acid, 500 ml of water). Agitate constantly—the result is blue in white areas and green-blue in light grey areas. Wash in an acetic acid solution, then wash thoroughly under running water

Robinson/Brown

Complete kit *The full Colorvir kit consists of 12 components. It can be bought as a set or as individual components—you may run out of one before you finish the others. Shown right is a typical print toning process—note the selective colours*

Lila Mann

Immerse the print in red dye for 3 mins. It will become dark blue, magenta red and a solarized golden-yellow

Lawrence Lawry

Colorvir on film

Film toning gives you control at the print stage. The monochrome original below was given a formula 7 solarize bath, followed by blue toner and a magenta dye, making the print (left). Be sure not to scratch the emulsion

visible particularly in the lighter parts of a print. A salt solution bath eliminates this—and you will need a lot of it.

Like all solutions in the kit, each of the toning solutions has a key letter and this is particularly helpful in identifying what is used, how, and when during the sometimes elaborate permutations of baths which are used to obtain some of the more exciting effects.

For example, the Colorvir blue toner is A and the red dye is K. The key to these letters is given in a separate panel. In this article, for clarity, the sequences of chemicals used and their dilutions are referred to in panels.

The basic toning kit of yellow and blue dyes yields a range of colours whose hues depend on how the solutions are used. With the help of other components of the kit and other chemicals, a considerable variety of tones in addition to the yellow and blue permutations can be obtained. Furthermore, on a single image several distinct colours may form according to the scale of grey tones contained in the original picture.

The Colorvir system works by first converting the black silver image in the print into a colourless, insoluble silver salt plus another metallic salt which forms the colouring of the final image. The silver salt is useful as it acts as a mordant for subsequent dye toning (that is, it prevents the dye from being washed out), but it must be removed at the end of the process otherwise it turns brown after prolonged exposure to daylight. This would ruin the toning effect, so the final part of the toning process is to briefly fix the toned print in a simple hypo bath consisting of a 50 g per litre solution of sodium thiosulphate. Immersion time in this must not exceed 30 seconds; a long wash then follows. Once a print is fixed, no further dye toning can be done—but prints can of course be tinted (dyed with a pigment) or hand coloured for other interesting effects. Toned but unfixed prints can be coloured further using the Colorvir chemicals for dye toning and 'sulphuration'.

A simple application of Colorvir is to tone a print blue, using a solution of blue toner and toner additive as described in Sequence 1 (see panel), followed by a salt bath and a rinse.

This gives a fairly uniform blue tone over the light and dark parts of the image. The toner intensifies the image, and you may find that results are better on underdeveloped prints. The longer you leave the print immersed in the toner, the greater the intensity of the blue becomes—if the blue 'runs' the treatment has been carried too far or the salt bath is exhausted. Excessive washing can cause the blue to fade but you can restore the colour by using a bath of 20 ml hydrochloric acid per litre of water. Do not use blue toner which is more than a day old.

Yellow toner has the opposite effect to blue in that it tends to weaken the image and so it is best to try the technique on slightly overexposed (but not over-developed) prints. The yellow toning procedure is given in Sequence 2. The length of immersion changes the colour from yellow to orange–brown, but avoid exceeding that time if you wish to follow yellow toning by dye toning. The addition of between 5 and 10 g chrome alum to the yellow toner bath is claimed to give copper-coloured light areas and warm brown dark areas. If yellow smears form, the toning bath is exhausted, or the treatment has been carried out for too long. Yellow-based toning can fade quickly, so subsequent dye or fixing stages must be carried out fairly soon afterwards.

The combination of the blue and yellow toners gives multicoloured images where the light greys of the image adopt one colour tone while the darker greys adopt another. Using two baths successively, as shown in Sequence 3, you can obtain a blue and yellow–green image corresponding to the light and dark greys respectively of the image.

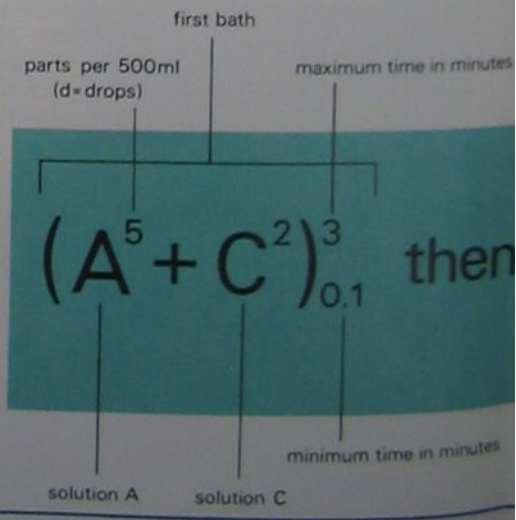
You can vary the result by changing the immersion times, but it is important to keep the blue immersion time shortest. If you have trouble with smears, try an intermediate salt bath between the two toners—this also prevents contamination of the second toner bath. By changing the order of the toners used you can obtain a yellow and blue–green image corresponding to the light and dark greys.

Multicoloured images are also possible by mixing yellow with a much smaller proportion of blue toner (which is stronger), but it is easier to predict results if separate successive baths are used. But you could try incorporating components from other parts of the Colorvir kit. To obtain a single colour image you can try solution D in one of a

The Colorvir (Jaffeux) process

The toning kit is needed to use components D to J. Additionally, components B to F are required if you intend to use the polychromic dye kit.

Unless stated otherwise, all measurements given in the sequences are for 500 ml dilutions. A bath of this quantity is sufficient for five to ten A4 prints where toning solutions are concerned, and 20 to 30 prints where dye baths are used. However, the salt solution is of maximum strength of 50 g per litre and should be replaced regularly—one litre is sufficient for only five A4 prints. Below, how to interpret the formulae.



number of ways. For an overall green image try Sequence 4, or, for a softer, more delicate green, try Sequence 5.

If you find the colour you obtain from any of these toning baths is too dark, immerse the print in a solution of either 3 g per litre of sodium carbonate or 2 ml per litre of ammonia. Keep an eye on the image and when it has lightened to your liking, rinse the print in a three per cent acetic acid stopbath. Then wash the print.

Some interesting effects can be obtained by partial or total removal of tone from certain areas of the image. All you have to do is to soak or swab the print in a mild alkaline solution such as used black and white developer. Bear in mind that you can only do this before the print is finally fixed and—for safety—always work in a good safelight to assess the effects if only partial redevelopment is required. Old toned prints cannot be redeveloped, nor can those which have received the 'sulphuration' treatment (see below).

Once restored to a purely black and white image, you can proceed to retone the image prior to any other stages. Redeveloped blue tones will, however, colour subsequent work in other colours.

Solarization effect

Solution D of the Colorvir kit creates an interesting side effect which the makers refer to as 'solarization' because of the uncanny similarity of results to genuine pseudo-solarizations (Sabattier effects) obtained by re-exposing partly developed film or paper during otherwise conventional processing (see page 1358). Print images display distinct areas of colour separated by border lines—the effect is not immediately noticeable and you have to proceed through toning baths or dyeing before you can gauge the results.

The effect does not work well on light images or those which have been underdeveloped—and some types of emulsion simply do not respond to this treatment.

A suggested procedure, which produces a yellow-gold image, is given in Sequence 7, or, for a stronger solarization effect, Sequence 8. The emulsion softens greatly during this particular process and particular care must be taken to prevent scratches—prints should be processed one at a time, for instance. The prepared solution can last up to a week if solution D is not exhausted.

To obtain a green and yellow-brown multicoloured image which shows the solarization effect, try Sequence 9. White areas will colour green, dark tones will be brownish and mid tones will be yellower—if one colour predominates, modify the immersion times or renew a toning bath which could be exhausted. A salt bath between first and second stages helps prevent carryover. Mixing a solarization effect bath with half the normal blue toning solution gives a blue and turquoise image (Sequence 10).

Rather special effects can be obtained by incorporating one or other of the dye solutions H, I and J at this stage. For a solarization effect where light greys of the original are turned yellow, and dark greys are turned to the colour of the dye you choose to use, try sequence 11. With dye H you obtain a violet and golden-yellow image, with dye I a turquoise and golden-yellow image, and with dye J a red and golden-yellow image—the darker parts of the original being golden-yellow in each case. As usual, the effect can be modified by adjusting the immersion times you use. If dyeing does not work the preceding stages were probably carried too far—but first check that the emulsion does respond to 'straight' solarization effects.

If the white areas of the print are still coloured by dye after washing, dip the print in a three per cent acetic acid solution (a stop bath made by diluting 30 ml acetic acid in one litre of water). Then give the print a final wash.

The polychromic dyes K, L and M may also be used for solarization effect prints but the effect is less marked. In fact, the solarization bath can be used as the start of the polychromic dye sequence (see page 1761).

What the system includes

Toning kit:
- A blue toner
- B yellow toner
- C toner additive

Special effects kit:
- D 'solarization effect'
- F 'freezing of grey'
- G 'sulphuration'

Dyes kit:
- H violet dye
- I green dye
- J red dye

Polychromic dye kit:
- K red dye
- L yellow dye
- M blue dye

1

(A^5+C^2) *then* (salt) *then* (wash)

2

$(B^5+C^{2.5})^3$ *then* (salt) *then* (wash)

second bath

$$\left(B^5+C^{2.5}\right)^3_{0.5}$$

solution B

3

$(A^5+C^2)_{0.5}$ *then* $(B^5+C^{2.5})_5$ *then* (salt) *then* (wash)

4

$(B^2+D^{2.5}+C^{2.5})^1$ *then* $(A^5+C^2)^{0.5}$ *then* (salt) *then* (wash)

5

$(A^{0.5}+D^2+C^{2.5})$ or $(A^5+D^2+C^{2.5})$ *then* (salt) *then* (wash)

Lawrence Lawry

'Freezing the greys'

Component F of the Colorvir process enables you to colour just the darker areas of your print, to leave behind—quite untouched—the lighter greys of the original image. By varying the concentration of solution F and the immersion time in this, you can adjust the balance between what is, and what is not, toned. Drops, and not millilitres, of solution F are used for each 500 ml working strength bath. Fewer drops are required in the blue toning sequence following the 'freeze' bath (Sequence 12). The darker greys, which do tone, take the colour blue. If you prefer a more yellow tone, use Sequence 13 instead of Sequence 12.

If results seem patchy, check that solution F is thoroughly mixed with water prior to use. Use constant but gentle agitation for this stage in particular. If no 'freezing' occurs, you have not used enough solution F or this bath has been too short. If no toning takes place after 'freezing', too much solution F was used, or for too long a time.

Prints may be selectively toned after full image toning, and sulphurated and dyed after the 'freezing' stage. An interesting accumulation of colour can be achieved as a result.

Sulphuration

This is the term Colorvir use to describe sepia toning—possible in either of two ways with the kit. The process may also be used to strengthen and modify colours and details of an image which has already been treated. The working strength bath of solution G gives off hydrogen sulphide and suitable precautions must be taken to avoid the unpleasant effect of this foul smelling gas.

The 'traditional' method of sepia toning starts with a bleach bath and you can make one using 10 ml solution C, 10 ml ammonia and 10 g salt (or, better, 10 g potassium bromide) with water to make 500 ml of working solution, which keeps well. Immerse the print in this for about 5 to 10 minutes or until the image is bleached and then wash the print for several minutes in running water.

Next, soak the print in a second bath consisting of 5 ml solution G diluted to make 500 ml of working solution. Unlike the rather 'instant' nature of conventional sulphide toners, the gentle action of this bath enables you to control the sepia toning from a light beige colour to warm brown simply by modifying the immersion times you use.

Another sepia toning method is possible using Colorvir, starting with a yellow-toned print and using Sequence 14. This gives a softer yellow image. This colour can be removed to leave a sepia result, if desired, by immersing the print for 2 to 5 minutes in a three per cent acetic acid stop bath before rewashing. The mustard-yellow image can be dyed—a bath in the red dye J will give sepia and rust-coloured tones.

Colorvir dyes

Dyeing is possible only on prints which have been toned and washed thoroughly afterwards. Also, prints must not be fixed after toning. Image colour can be changed greatly in any sequence of baths by adjusting immersion times and washing times. Using dye J (red), for example, in Sequence 15, you can alter the image from yellow and red to one of red and orange by increasing the first wash from 10 seconds to five minutes—and by prolonging the time in the dye bath beyond the suggested maximum a much stronger magenta colour is obtained. Substituting dye I for J in Sequence 15 gives yellow tones in light grey areas and turquoise green in dark areas of the original at one extreme, and a purely green turquoise image at the other if the same variables are used.

Another variation is possible by

6

$(A^2+D^{2.5}+C^{2.5})$‖
or $(A^{2.5}+B^2+C^{2.5})$‖
then (salt)‖ *then* (wash)‖

7

$(B^2+D^{2.5}+C^{2.5})$‖
then (A^1+C^2)†
then (salt)‖ *then* (wash)‖

8

$(C^{2.5}+D^5)$‖ *then* (salt)‖
then (wash)‖

9

$(B^2+D^{2.5}+C^{2.5})$‖
then (A^1+C^2)‖, *then* (salt)‖
then (wash)‖

14

$(B^1+C^{2.5})$‖ *then* (salt)‖
then (wash)‖ *then* $(G^{1.5-5})$‖
then (wash)‖

15

$(B^1+C^{2.5})$‖ *then* (salt)‖
then (wash)‖, *then* (J^{20})†
then (wash)‖

16

$(B^1+C^{2.5})$‖ *then* (salt)‖
then (wash)‖, *then* (dye[20])†
then (sodium carbonate[5])‖
or (ammonia[20])‖ *then* (wash)‖

17

$(B^1+C^{2.5})$‖ *then* (salt)‖
then (wash)‖ *then* (J^{20}+acetic acid[1])†
then (wash)‖

Lawrence Lawry

Lawrence Lawry

Freezing the greys *Many subjects can be effectively treated by this process. Here, the grey tones were first 'frozen' and then the print was given a blue toner, giving this interesting image*

following a plain dye bath with another of either a two per cent sodium carbonate solution or five per cent ammonia solution. This removes the colour of toning after the dyeing stage leaving, with dye J, a pink image and, with dye H, a bluish image. The procedure is shown as Sequence 16.

The addition of acetic acid in conjunction with dye J gives red in the dark areas of the image while retaining the yellow of the toner in the lighter areas in Sequence 17.

Acetic acid may also be used as a five per cent solution bath after dyeing to give a violet image when dye H is used (Sequence 18).

Although a start with yellow toning gives the best results where dye work is concerned, some interesting effects can be obtained after blue toning, or after combining blue and yellow toning. By adding F to blue toner you can get a grey and blue image (Sequence 19).

This image responds well to red dyeing as shown in Sequence 20, to give an image which has blue to red–violet tones. A soft gradation print should be used to get the most effect from this combination of baths.

If the white areas remain coloured after dyeing, the wash after the dye bath is too short—but if magenta–red persists, washing times are too long. Light areas may also become coloured if the washing time after the salt bath is too long, or if the immersion in the dye bath is too long. But first try bathing the print in a 5 to 10 per cent solution of acetic acid to clear any residual colouring.

Polychromic dyeing

Prints with large areas of white or very light grey form an ideal basis for the polychromic dyes K, L and M of the kit, which can be used to colour these particular tones of a print. A freeze or solarization effect toning bath is used to start Sequence 21.

The acetic acid bath helps the formation of colour in the whiter parts of the image as well as preventing colour 'spread' during washing and drying. The dye bath can be diluted even further beyond 5 to 10 g per half litre if better control is required over the colouring effect. You can also mix the dyes together in any proportion to obtain a variety of colours. Other effects can be obtained using subsequent blue or yellow toning, by dyeing with I or J, by sulphuration, or simply by weakening the colour intensity (using a mild alkali bath, as outlined above).

10

{$A^{2.5}+B^{2}+C^{3.5}+D^{2.5}$}
then (salt)} *then* (wash)}

11

{$B^{2}+C^{2.5}+D^{2.5}$}} *then* (salt)}
then (wash)}} *then* (chosen dye[20])}
then (wash)}

12

{$F^{3.10d}$}} *then* ($A^{5}+C^{2}$)}
then (salt)}} *then* (wash)}

13

{$F^{0.30d}$}} *then* ($B^{5}+C^{2.5}$)}
then (salt)}} *then* (wash)}

18

($B^{5}+C^{2.5}$)} *then* (salt)}
then (wash)}[3] *then* (chosen dye[20])}
then (acetic acid[20])}
then (wash)}

19

($A^{5}+C^{2}+F^{5}$)} *then* (salt)}
then (wash)}

20

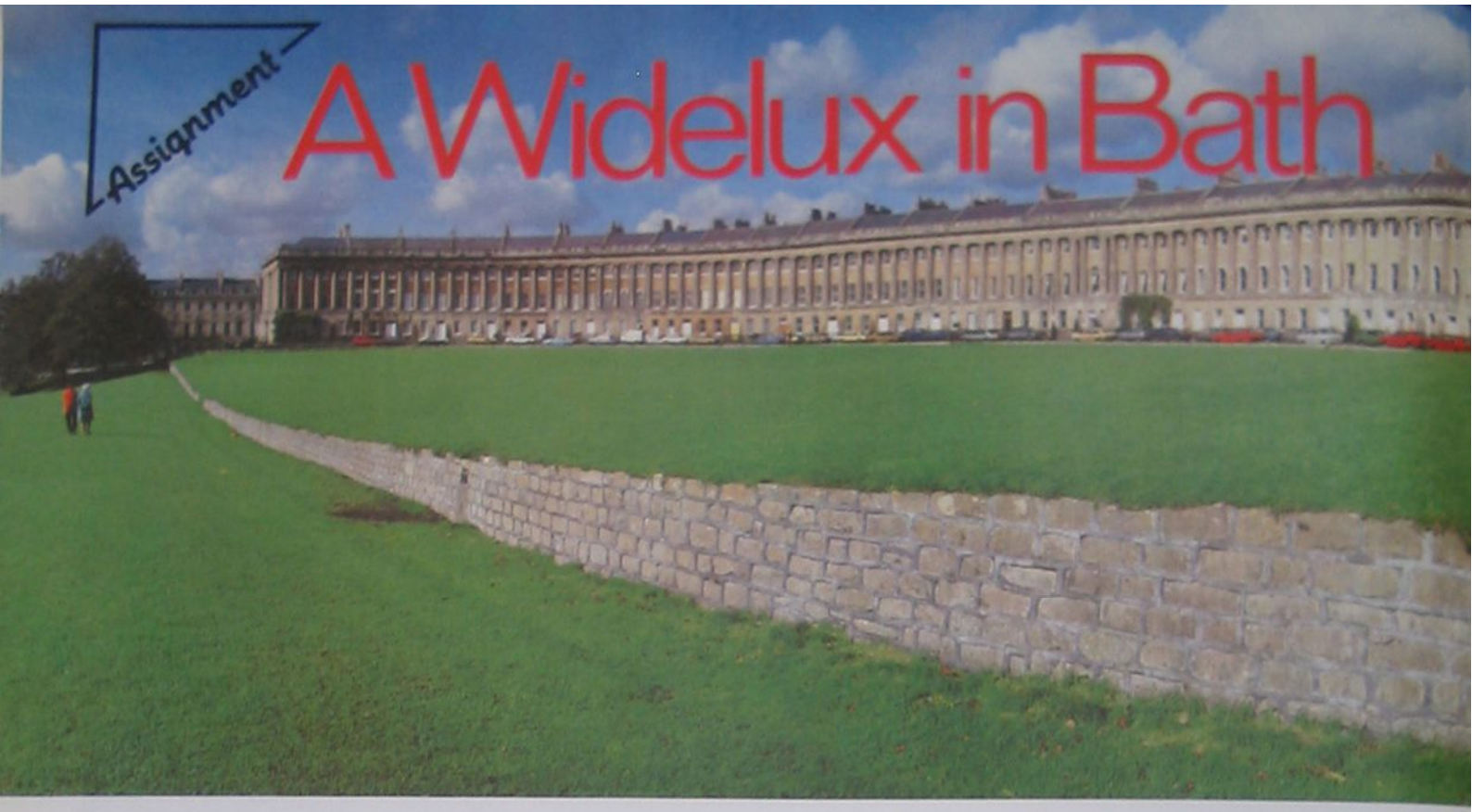
($A^{5}+C^{2}$)} *then* (wash)[3]
then ($F^{3.10d}$)} *then* (wash)[3]
then ($B^{5}+C^{2.5}$)} *then* (salt)}
then (wash)} *then* (J[20])}
then (wash)}

21

($F^{5}+B^{1}$ *then* $+C^{2.5}$)}
or ($B^{2.5}+D^{2.5}+C^{2.5}$)}
then (salt)} *then* (wash)}
then (K, L or $M^{5.10}$+acetic acid[20])}[5]
then (wash)}[5] *then* (acetic acid[20])}
then (wash)}[2]

Assignment

A Widelux in Bath



For a more unusual assignment, we asked John Freeman to try out a Widelux panoramic camera for taking wide sweeping views as well as some less likely shots

To investigate the potential of a panoramic camera for use with everyday subjects we hired one, and asked photographer John Freeman to spend a day photographing the well known Georgian city of Bath. The Widelux is a 35 mm rangefinder camera which exposes a frame of twice the normal width. Since its 26 mm lens rotates through a 140° arc during an exposure, the camera offers a view similar to that seen by the human eyes.

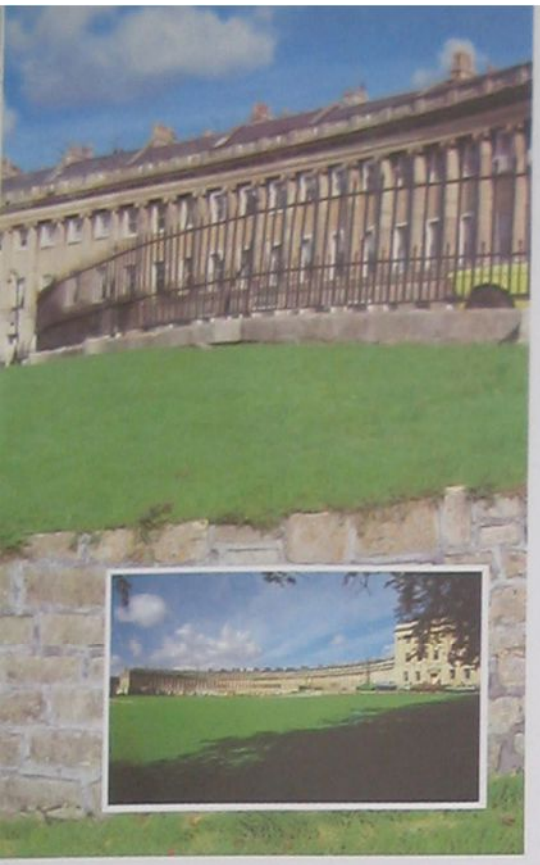
One result of this system is that at close range the centre of the image is bowed towards the camera, and John found that he had to bear this in mind when choosing subjects and viewpoints. For example, a head-on view of the famous Royal Crescent would have resulted in the camera straightening out the row of buildings and John found a far more satisfactory shot could be made by standing at a 45° angle to the subject.

Although it looks like it could easily be hand-held, in practice a tripod was almost essential for the Widelux. John explained, 'Not only is it very easy to include your fingers in the shot if you hold the camera in the normal way, but also, with such a wide format, it is important to ensure that it is kept absolutely level. This can only be guaranteed by mounting the camera on a tripod and checking with the horizontal and vertical spirit levels that are built into the body.'

John used the exposure readings indicated by his Pentax SLR to make the

settings on the Widelux—there is no built-in meter. Since the shutter speeds are limited to 1/15, 1/60 and 1/250 second, there is less flexibility than one expects of a conventional camera, although it can still cope with most normal lighting conditions. All shots were taken on Kodachrome 64 using a shutter speed of 1/16 second and apertures around f/11.

John added that the time he had with the Widelux was hardly enough to explore the camera's potential. 'The format and the perspective are both so unusual that it takes a major rethink in technique and choice of subject matter to produce images that you feel really happy with.'



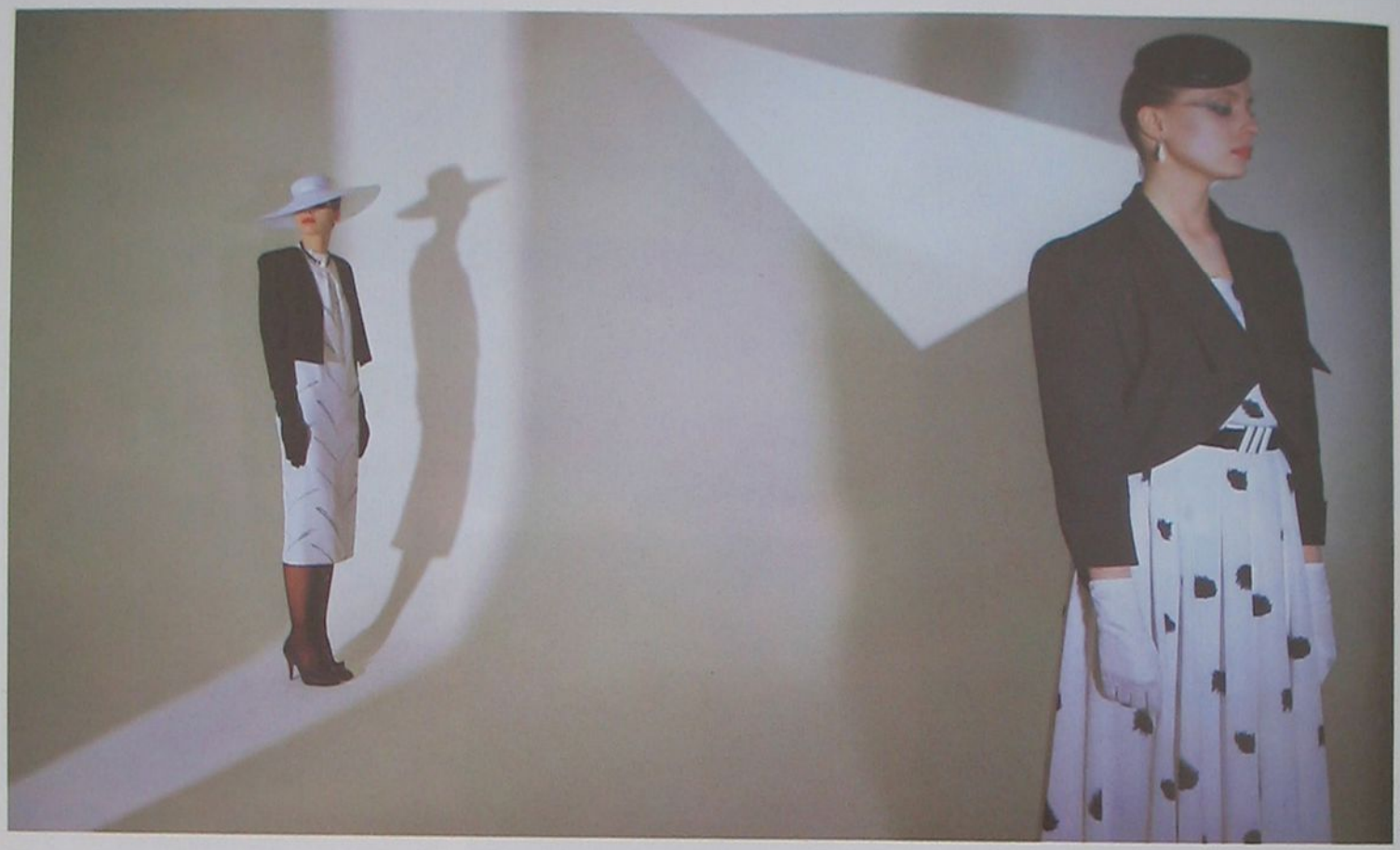
Royal Crescent *This seemed like an ideal subject for the Widelux, but John had to photograph it from an angle to avoid distortion.* **Normal view**—*taken with an SLR and 28 mm lens*

John Freeman

Road work *Using the camera vertically and including plenty of foreground detail produced an unusual view of a familiar scene (above).* **Fountain** *Here, the characteristic distortion of the Widelux has been used for effect.* **Young girl** *A figure in the edge of the frame added extra interest to this panorama.* **Landscape** *Just outside the city, the winding River Avon provided more orthodox subject matter for the Widelux*

Flash meters and slaves

If you frequently use several flashguns together for studio work, you can simplify exposure calculations and make working with this equipment more convenient with flashmeters and slave units



Akira

Creative lighting *In pictures using more than one flashgun, a flashmeter is essential to help balance the illumination from the units*

For many shots, particularly studio portraits and close-up work, you often need to use several flashguns at once. Obviously this is more complicated than using a single gun and if you use multiple flash frequently, it may be worth acquiring a flashmeter to make exposure calculations easier or slave units to synchronize the firing of the flashguns without having trailing leads.

Slave units

The basic slave unit is essentially a light-sensitive cell which activates a tiny switch linked to the extra flash unit by a normal flash lead connection. The cell reacts to the fast burst of light from a flashgun but it is unaffected by sunlight or any other continuous light sources. So when the 'master' flash linked to the camera is fired, the slave reacts instantly and triggers the extra flash unit. In fact, the master flash need not contribute to the exposure at all but can simply serve to trigger off the other flash units via slave cells—it can be a small unit fitted to the camera's hotshoe.

The slave does not usually have to receive direct light from the master flash. Most units can be triggered by flash light reflected from walls, ceilings or surrounding objects. A great deal

Plug-in slave *Many studio flash units, such as this Monolite, have special sockets which take both normal slaves (as in this case) and infrared units*

Dave King/equipment courtesy of Bowens, Minolta & Courtenay

Meter readouts *The range of readouts available includes simple meters (top left), LEDs (top right), LCDs (bottom left) and illumination arrows*

Invisible link *Infrared slaves can be fitted to the flash. The transmitter is triggered either by hand (for cordless metering) or by the camera*

depends on the sensitivity of the unit—some will operate at distances of up to 30 m—though it is almost impossible to tell how sensitive a unit is without actually using it. As a general rule, the more expensive the slave, the more sensitive it is likely to be.

Some basic slave units can be very small—about the size of a thumbnail—while others designed for professional studio flash outfits are quite large. For the amateur the small units are perfectly adequate, and their size can be a great advantage in situations where fixing a larger unit in place is difficult. In fact some of the small units have rubber suction pads by which they can be attached to any smooth surface, such as the flashgun itself. Other units incorporate a tripod bush and a hotshoe. This allows large flash units to be fixed to tripods and also permits the use of small guns which do not have flash lead connections but must be fired using the hotshoe.

Some studio flashguns have slave cells built in. Others, such as the Bowens Monolites, have sockets into which a slave cell can be plugged. And some of the more advanced units can be fired using special infrared devices. With these the master or main flash is replaced by an emitting device which fires a synchronized pulse of infrared light. This triggers the special slave units attached to the flashguns. The main advantage of this system is that none of the flash units need to be connected to the camera, so dispensing with both the flash leads and the flash on the camera.

Making use of slave units gives the maximum possible flexibility with flash lighting. The flashguns can be positioned freely, enabling you to create any lighting effect you want. In particular, separate areas of the subject can be lit by separate light sources, a small gun can be introduced to provide back-lighting, and so on.

Metering the flash

Employing several units together creates one major problem, however, in that the correct aperture to use with a given set-up is almost impossible to calculate using normal guide numbers. The scales on the majority of portable flashguns, and the guide numbers quoted for them, are usually approximations. They take no account of the reflective properties of the surroundings—a subject receives more light from the flashgun in a small white room than it does in a large dark hall because of the light reflected from the walls and ceiling. So these guides are inadequate for really critical exposures, especially in close-up work.

With several flashguns used at different flash-to-subject distances the situation becomes more difficult. And a further complication occurs when the flashguns have different power outputs, especially if the light from the units overlaps in varying amounts.

All these factors make it almost essential to use a meter to find the correct exposure. Conventional meters do not respond to the brief duration of flash so it is necessary to use a special *flashmeter* or attachment. These use a fast responding light sensor, such as a silicon photo diode, and help you to determine the correct aperture quickly and easily.

The simpler flashmeters, such as the Courtenay 303, are connected to the flash by a normal flash lead. Pressing a button fires the flash and a needle on the meter indicates a number. This number corresponds to an aperture shown on a dial. Such meters are inexpensive and are suitable for most flash situations. They are used like a standard incident meter (see page 365) with spherical diffusers giving an acceptance angle of 180°. A few models have flat diffusers with an acceptance angle of 60° and so allow slightly more selective metering.

Many flashmeters also allow reflected light readings. This is achieved by replacing the diffuser dome with a lens unit, or by simply sliding the dome out of the way. This facility is useful when it is impossible to get right up to the subject to take a normal incident reading.

Unfortunately, for a long session with many readings, the lead between flashgun and meter can be very inconvenient involving constantly switching the lead from the camera to the meter. So many flashmeters offer cordless operation. With this method a button is pressed to activate the meter and the flash is fired manually. Most meters of this type remain activated for 30 to 60 seconds so that there is no rush to fire the flash after pressing the button. For maximum versatility some meters, such as the Calcuflash, offer both types of operation —cord and cordless.

Light level readout

The Calcuflash, in common with many of the more modern meters, has another advantage over the simpler models in that it uses an LED (Light Emitting Diode) readout—like a digital watch—rather than a moving needle. This type of readout is more robust as there are no moving parts involved.

A few models, including those made by Vivitar and Minolta, have Liquid Crystal Displays (LCDs) which have all the benefits of LEDs plus the advantage of using less battery power. As some meters take up to four hearing-aid type batteries this can be an important point.

Another valuable feature of some of these meters is that they give readings in actual *f*-numbers rather than index numbers. This means that you can tell at a glance what the aperture setting must be. This can save a considerable time and effort when you are adjusting the flash power or position to give a particular *f*-stop, rather than adjusting the *f*-stop to suit the flash. Most meters of this type have symbols to indicate settings between the main *f*-numbers in steps of one third of a stop. This is probably the clearest and easiest to understand of all the types of readout, and the one third stop settings are accurate enough for any film. Even so at least one meter gives readings in precise *f*-numbers, such as *f*/19 or *f*/7, though this type of accuracy is rarely needed by the amateur.

One variation on this idea is employed by the Bowens SSR. This has an array of 15 LEDs arranged in a semicircle around a dial numbered with the aperture values. The correct aperture is indicated by the LED that lights up.

Just as important as the type of readout is the range of the scale. Many of the more expensive meters have aperture ranges running from *f*/1 to *f*/128 or even *f*/180. These extremes are rarely needed, even by professionals, and for amateur use a range of *f*/2.8 to *f*/45 is ample. However, when choosing a flashmeter it is worth checking that it will give this range at all film speed settings. Even this aperture range may seem extreme at first sight, but in close-up work where extension tubes or bellows are being used it is possible that effective stops of *f*/32 and *f*/45 could be needed.

Although your flashgun may not be powerful enough to give an aperture this small when used normally, it is often possible to build up the exposure with multiple flash. In a totally dark studio or room, with the camera shutter open on the B setting, the flashgun is fired manually several times until the required exposure level is reached. The effect is like using a much stronger light and it is very useful for still lifes as it gives greater depth of field. However not all flashmeters allow readings to be built up in the same way, so this is a feature worth checking for.

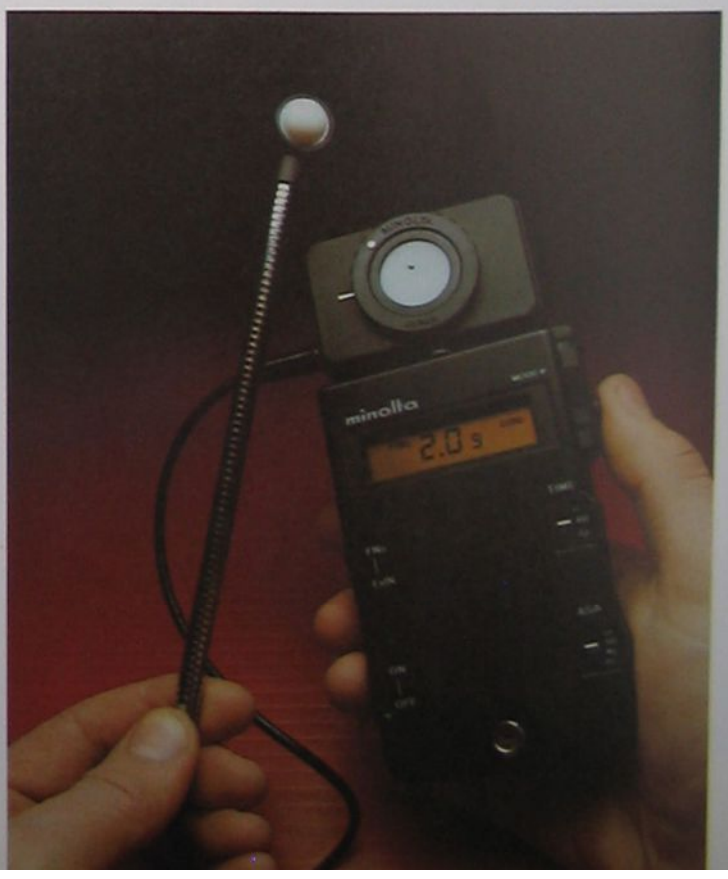
One point to note is that the whole aperture range may not be contained in one scale. Like many normal exposure meters, flashmeters often use two scales —'high' and 'low'. It is worth trying the meter to see how easy it is to change between the two. The Courtenay meter, for example, simply uses a slide which is pushed one way for high and the other way for low. This system is quick and easy to use and can save a lot of fuss.

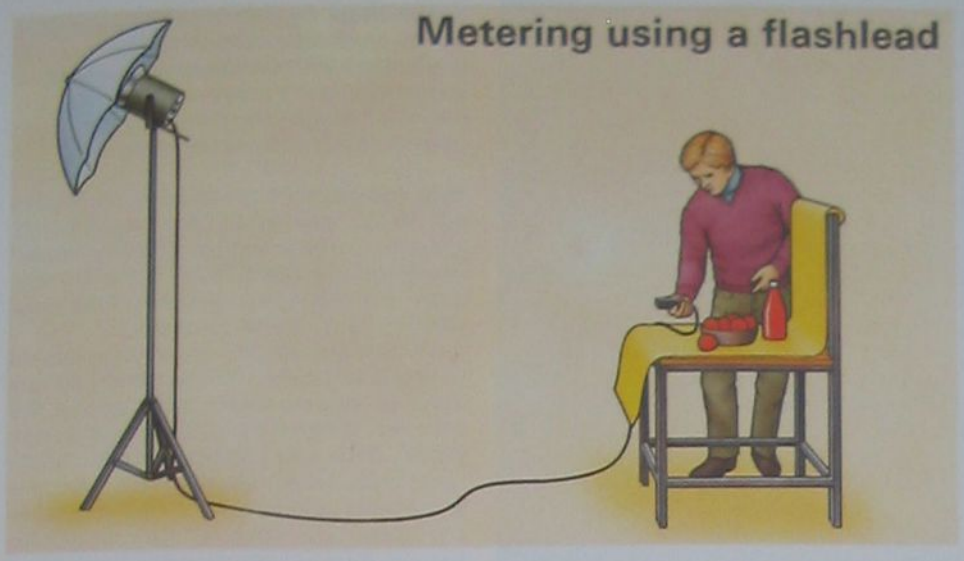
In addition to measuring the amount of flash light some of the better meters measure the ambient light. This is a very valuable feature when using the flashgun for fill-in work or when using slow shutter speeds. On such meters, there is usually a dial with a range of shutter speeds. The meter automatically takes the shutter speed into account when it gives the suggested aperture setting. The range of speeds is usually just those which you are likely to encounter in normal flash photography—from 1/15 to 1/500 second. But very advanced meters like the Minolta have a huge range and so can be used as normal exposure meters.

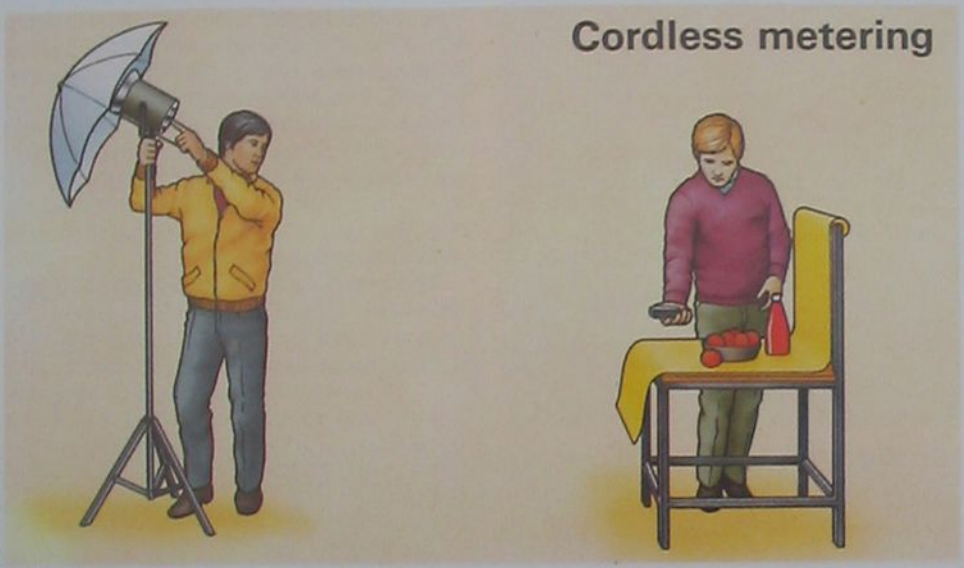
Additional features

One extra design feature to look for is the positioning of the meter cell. Many meters have the cell on the front edge so that, when the meter is in the hand, the cell is pointing forwards. This is perfectly adequate for most situations, but in copying work, for example, it is often better if the cell is on top so that the meter can be placed flat on the surface being copied with the cell still pointing towards the camera. With the Minolta Flash Meter III the cell is not only on top but also mounted in a rotating head so that it can be turned in practically any direction. The Calcuflash and Vivitar meters have accessory diffuser domes

Dave King







Jeremy Gower

which provide a similar facility.

Multidirectional metering is an extremely valuable feature when photographing small objects, such as still lifes, because the cell can be placed right next to the main subject. But, even so, there are times when there is insufficient space to insert the meter near the part of the subject you want to measure. So some of the more advanced meters include a meter 'eye' attached to a fibre optic cable. The 'eye' itself is small enough to fit in tiny spaces and the light is passed to the meter by cable.

For reflected light readings of small or inaccessible areas the top models also offer spot reading accessories. These take the place of the diffuser dome and usually incorporate a viewfinder so that the precise area being measured can be seen. The angle of view varies between 1° and 10° according to the model.

An even more sophisticated accessory is the Minolta Booster which connects to the Flash Meter III via a normal cable. This unit allows direct flash readings to be taken from camera focusing screens, viewfinders and even from the film plane of 35 mm cameras.

These sort of accessories are quite specialized and it is unlikely that the average photographer would ever need them. But if you do a great deal of close-up work or copying then something like the booster could prove useful.

Your choice, therefore, depends on the features you are likely to need. With a studio or room—even the simplest meter is perfectly adequate. But if you are interested in experimenting with flash, or using it in more difficult circumstances, then a more sophisticated meter is probably the best choice.

Metering methods *Using a meter with a flash lead is very simple but involves trailing wires and constant switching of the lead between the meter and the camera. Cordless metering is often more convenient, especially if you get someone to fire the flash for you*

On the spot *Some of the more sophisticated meters allow selective reflected light readings to be taken by the addition of a spot metering attachment (far left)*

Meter probe *This probe is a useful accessory for taking incident readings in situations where the complete meter would prove clumsy or be impossible to position*

Shutter dial *A few meters allow you to set the shutter speed in use so that the reading given automatically compensates for the existing light (left)*

Meter cell *The cell position can affect the versatility of the meter. The best type uses a rotating head*

Dave King

Yellow field *Exploiting colour contrast can be an effective way of taking landscapes with a difference. Keep the image extremely simple and use the frame to 'design' the picture—note how the cloud echoes the wood*

Franco/Fontana/The Image Bank

Creative approach

Colour contrast

Photographers often keep to the subtle hues of nature, but for a striking, lively series of photographs, you can exploit the creative possibilities of strong, contrasting colour

In the early days of colour photography, when colours could only be rendered in pale and muted hues, photographers naturally tended to select subjects suited to a pastel look. With modern emulsions, however, colours can be bright and fully saturated and the handling of colour in photographs has developed accordingly. Just like other visual artists such as painters and interior designers, photographers have begun to explore the creative potential of strong, contrasting colours.

Reactions to different colours seems to vary so much from person to person that it seems colour response is largely subjective—perhaps this is because so little is known about human colour vision. Yet there is no doubt that most people find strong colours more stimulating than weak colours, if not necessarily more pleasing—bright red even sounds more exciting than pale red. Naturally, then, a photograph containing strong, bright colours tends to provoke a more positive response than one in which the colours are generally pale. At the simplest level, this means that it is often worth including a splash of colour in the frame to 'lift' the picture (see page 233). But there is no reason why you should not go much further and make strong colour the dominant element.

Strongly coloured pictures are not necessarily completely satisfying—that depends on the way the colour is used—but they can often be immediately attractive, which is why so many advertisements use them. They catch the eye and provoke a definite response, whether it is of like or dislike.

Of course, there is no shortage of potential subjects. To the generally soft hues of nature, have been added the colours made possible by modern paints, dyes and plastics. Bright colours—once the preserve of flowers—are now to be found everywhere. City centres in particular are often a riot of colour. Indeed, bright colours have become so commonplace that it is easy to pass them by without noticing—and this is the photographer's chance. You can move in and isolate them with the camera, to bring them back into view and show what a colourful place the city can be. Or, by selective framing, you can use the areas of bright colour in much the same way that the artist uses paint, and create almost abstract images.

The beauty is that virtually any brightly coloured object can be turned to creative use. By closing in and isolating it from its surroundings you can treat it in such a way that the colour is highlighted and its function becomes all but irrelevant. The yellow dustbin is no longer a dustbin but part of a design in yellow; the side panel of a red bus is no longer just a side panel but a red picture: and similarly with many other objects, from drainpipes to doorknobs.

Simplicity is the essence of these pictures. Too much fussy detail ruins the effect. Concentrate on small uncluttered areas and aim to include just one or two strong colours in the frame—any more tends to confuse the eye and actually reduces the impression of brightness in the image.

However, it is not always enough to merely frame an area of bright colour: you should try to manipulate it to create a photograph. It is easy to be beguiled by the attractiveness of strong colour into thinking that once you have isolated the colour in the viewfinder, you have done enough. But the effect soon palls.

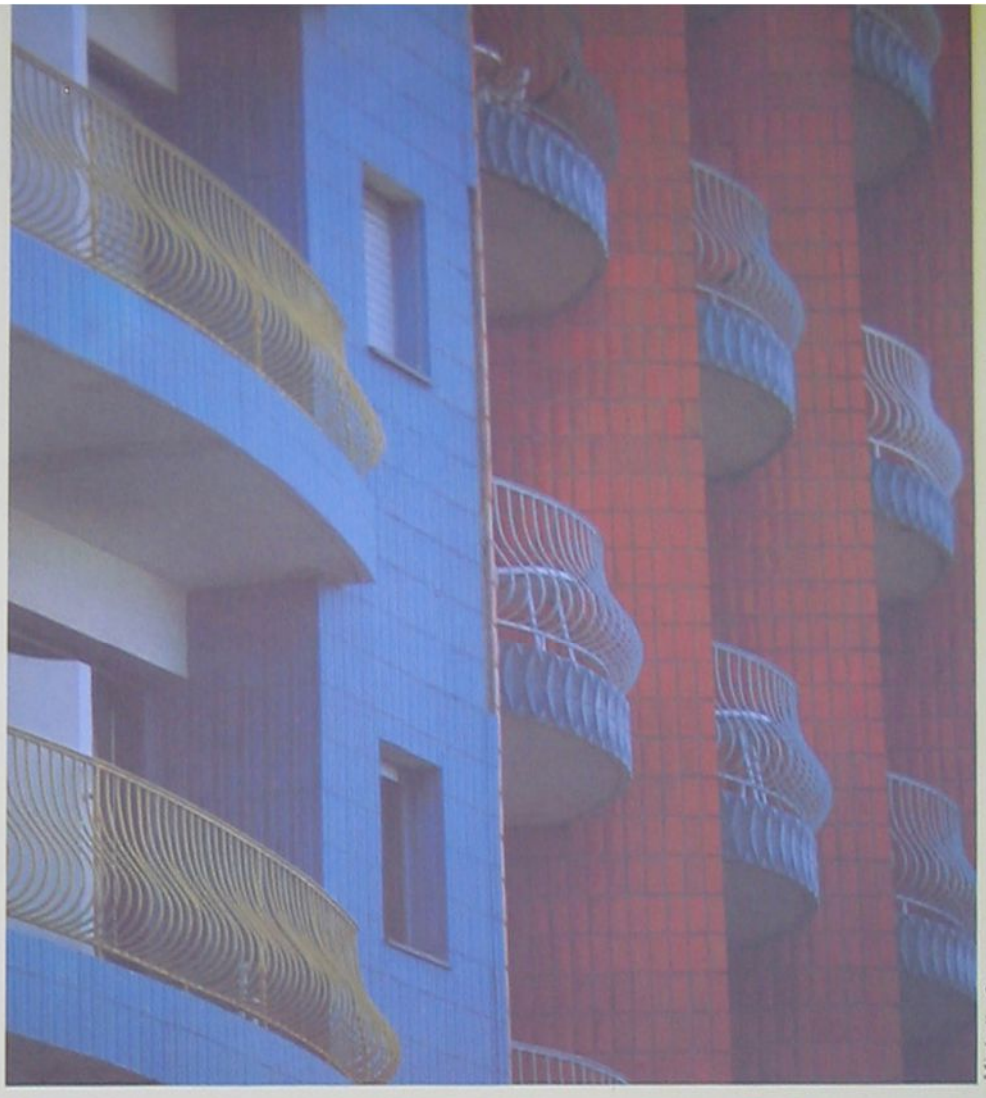
Look for blocks of colour, lines, shadows, texture and other details and use the frame to arrange them into a design. If there is a strong line across the surface of your subject, for instance, use it positively to enhance the mood. With an abstract approach, there is no reason why the camera should be held level—an unusual angle giving strong diagonal lines can often help to accentuate the vibrant, energetic effect of strong colour.

Alternatively, look for small, interesting details to act as a focal point—there is no need for the picture to be completely abstract. In a shot of a glossy car door, for instance, something as in-

Balconies *Although colours in the shade are generally dull, a subtle contrast can make the shot interesting*

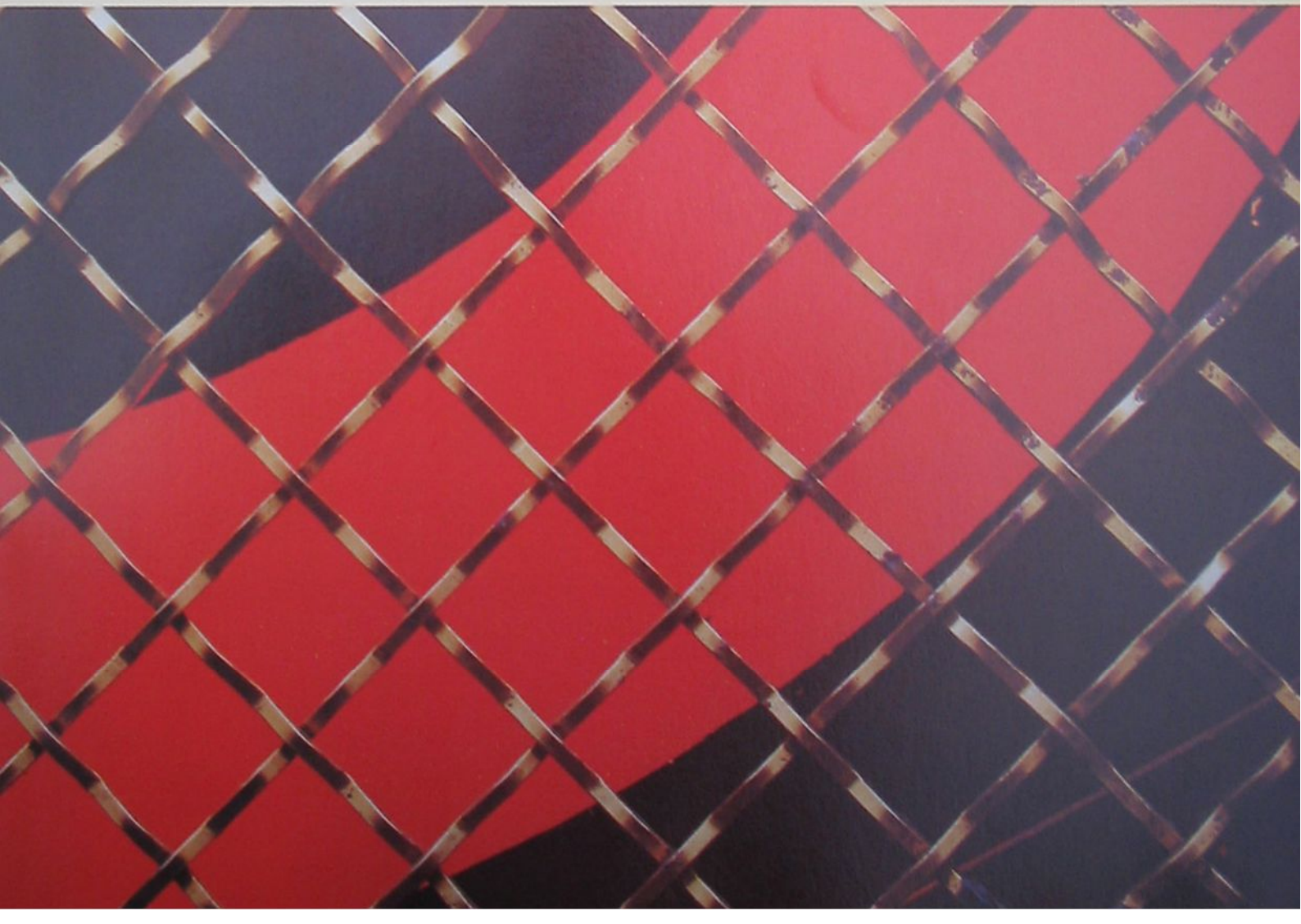
significant as the door handle might be enough to draw the eye and lift the picture out of the ordinary. In a shot of the slab side of a newly painted ship, a tiny human figure might provide the same function.

For these strong colour shots to have their full impact, of course, they must be bright and well saturated. The diffuse lighting of a dull day is often recommended for full colour saturation, but this only really works well for soft, subtle hues; strong colours tend to lose some of their brightness in dull, cloudy weather. So although saturation may actually be less, it is better to wait for strong sunshine. Indeed it seems that the more light there is, the better, for this kind of shot. Beaches and coastal resorts where strong sun is reflected from the sea, and modern cities where white concrete and glass surfaces throw light everywhere, are undoubtedly among the best places to work—and, of course, there is usually plenty of subject matter available.



Michelle Garrett

Red band *Strong colour can give even the most mundane object potential for striking abstracts. Remember to use lines and blocks of colour—like the broad red band sweeping from corner to corner in this shot—to create a complete picture*



John Sims

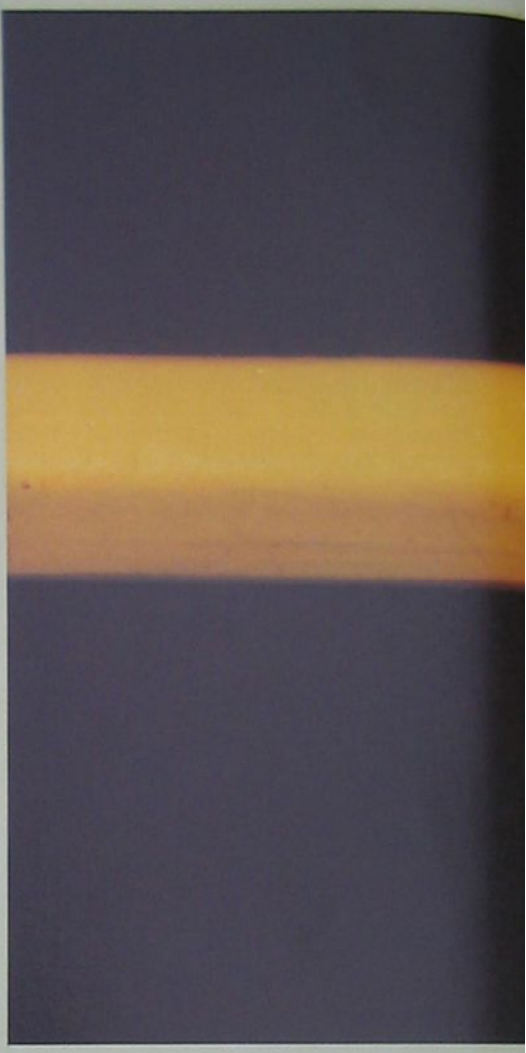
Blue corner *An unusual view of a familiar sight, the corner of a pool —strong diagonals enhance the high energy feel of colour contrast pictures*

One problem is that in strong sunlight it is easy to overexpose shots, giving pale, washed out colours. It is important, therefore, to underexpose—perhaps up to full two stops—to give colours their full value.

But perhaps the most interesting way of giving colours their full impact is to exploit colour contrast. It has been firmly established by psychologists that our judgement of the brightness of a colour is strongly influenced by the surrounding colours. If you look at two identical squares, one with a black border and the other with a white, the square surrounded by black will seem much brighter than the white edged square. In contrast to the black border, the square seems very bright to the eye: next to the white border it does not. So whenever there is a dark tone—light tone border, the dark tone seems darker and the light tone brighter than it actually is.

Contrasting colours are essentially colours opposite each other on the colour circle (see page 551)—that is, complementary colours such as blue and yellow, red and cyan, and green and magenta. A colour will appear to be much brighter next to its complementary than next to any other colour. And even when the adjacent colour is not complementary, the eye tends to see it as if it is.

You can exploit the way the eye reacts to colour contrast to give strong colour pictures an added vibrancy—and also to increase the impact of many other shots. So when out looking for strong colour shots look for colour contrasts in particular—wherever there is a good colour contrast, there is

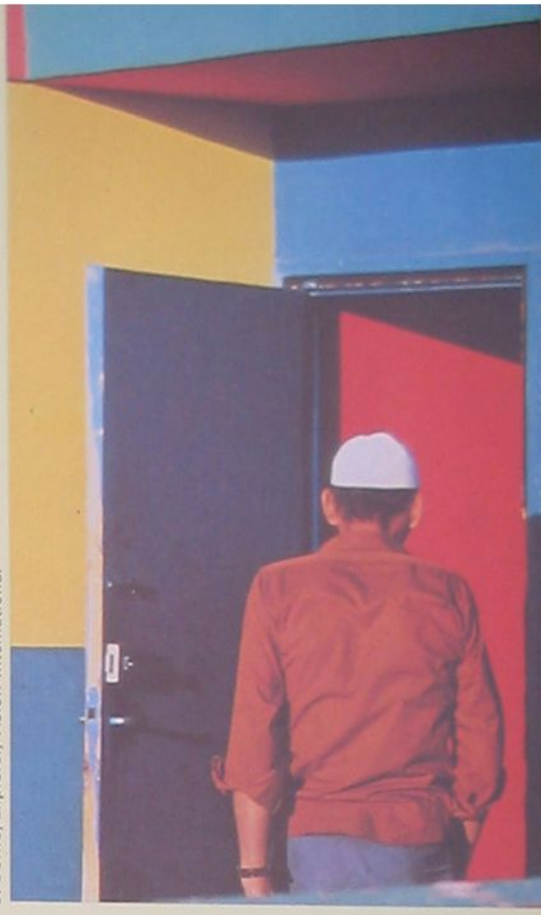


Making a point *A pure black makes an effective background for any brightly coloured subject*

potential for a shot.

Because of the tendency of the eye to maximise the differences between colours, the colours need not be complementary for an effective contrast. Indeed, one of the most effective contrasts is between red and blue. Because red 'advances' in a picture and blue 'recedes', the difference between them can be so marked that a picture that is just pure red and pure blue seems to positively vibrate. So for a vibrant, high energy effect, you could look for a low viewpoint of bright red objects to contrast them against a piercing blue sky. To enhance the effect, use a polarizing filter to deepen the blue of the sky.

Although blue and red provide the most striking contrasts, many other combinations, both subtle and strong can be very effective. But it is important that the boundaries between the colours are very marked—soft edges reduce the effect of the contrast. This is why man-made environments often have more potential than nature. Colours should also be fairly pure—gradations of colour similarly tend to reduce the effect. So places where strong sunshine flattens colours and where there are plenty of large, simple shapes are the best



J. Joffre/Explorer/Vision International

John Garrett

Doorway *An array of colours as varied as this rarely works though here the simple, angular shapes help make a successful shot*
Brown windows *Brightly painted woodwork can be found almost everywhere and is surprisingly photogenic*

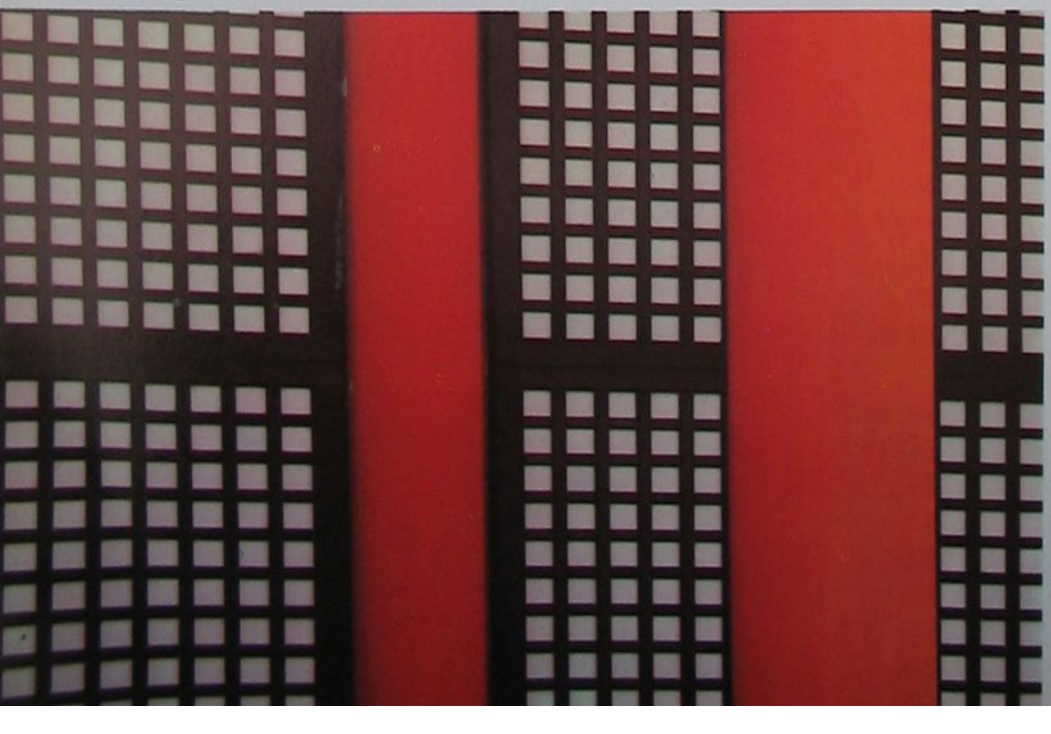
Trevor Wood

hunting grounds—again modern cities and also beaches and deserts are the places to look.

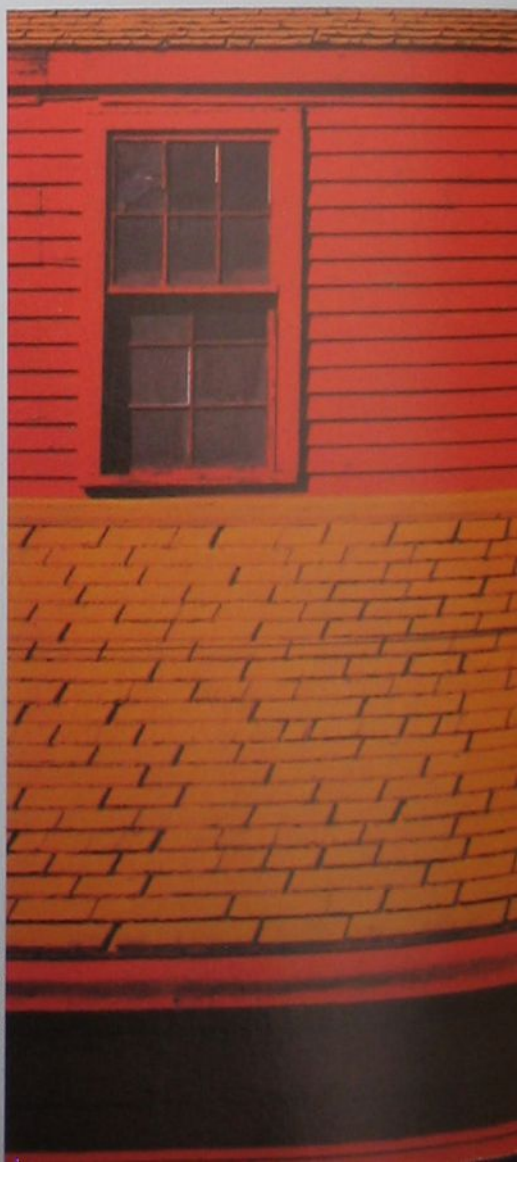
While strong colour contrast is ideal for striking abstract and surreal images, you can also use it in many other contexts to enliven an image. It can help, for instance, to choose the colour of your background by looking for a contrasting colour.

In the studio, for instance, you can use a cold blue background to contrast with warm skin tones—advertisers often use a blue background to give an extra glow to the amber of a glass of whisky lit from underneath. But whatever you choose to do, remember that colour appreciation is largely subjective—a colour combination that seems attractive to you may be stomach churning for someone else.

Hang glider *The strongest colour contrasts are between complementary colours such as orange and blue.*
Yellow roof *For bright, well saturated colours, shoot in strong sunlight and underexpose by a few stops*

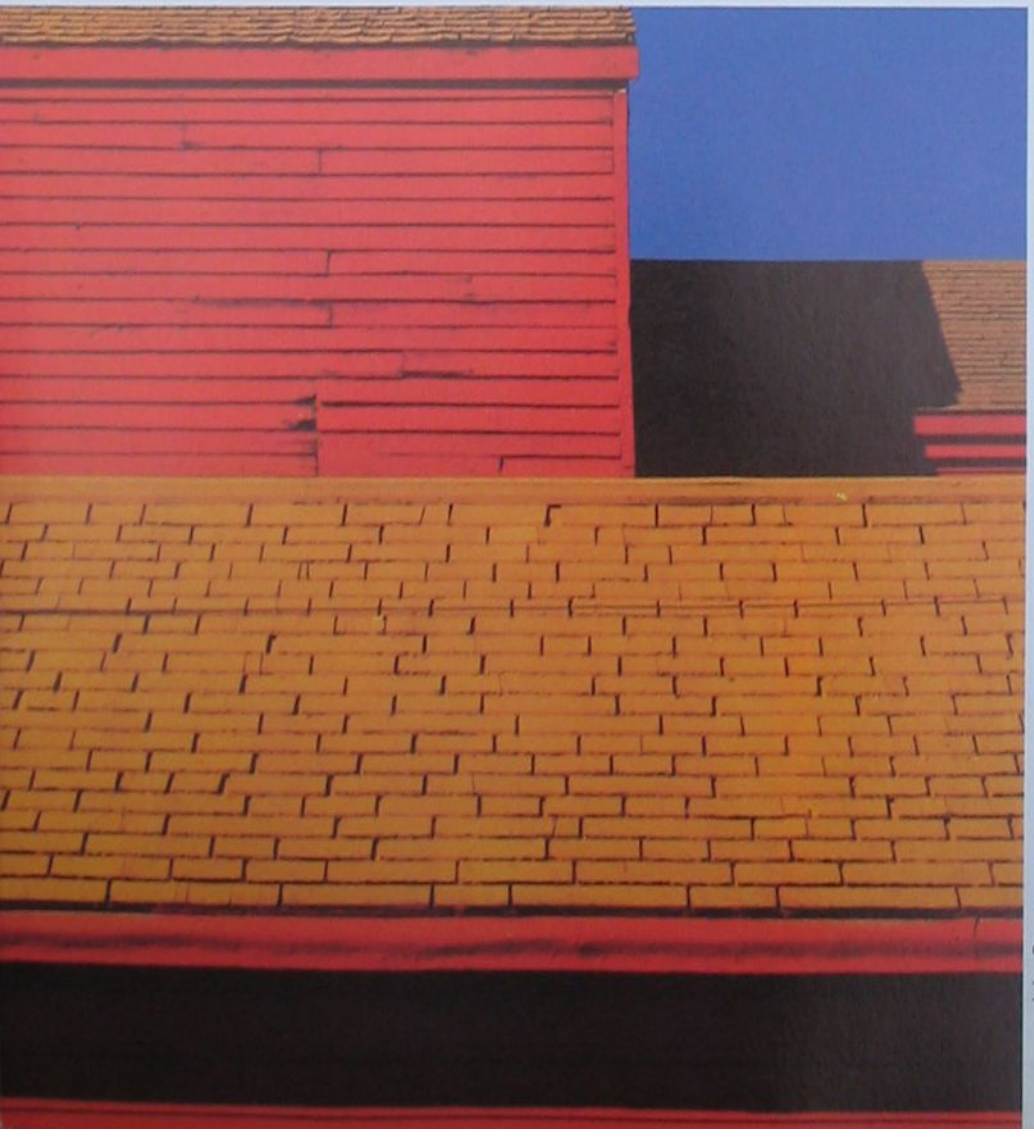


Sliding doors *Look out for bright reds. Colour film is particularly good at rendering them accurately*



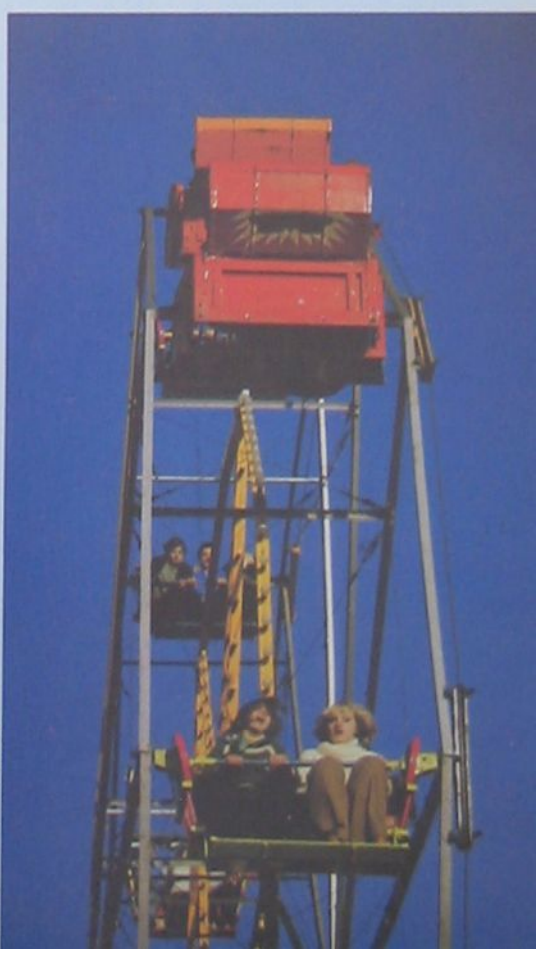
Susanne Hill

Susanne Hill



John de Visser

Rice harvest *In scenes with mostly natural colours—browns and greens —look for some red to enliven the shot*
Big wheel *Set a bright red subject against a clear blue sky and use a polarizing filter to make it richer*



John Garrett

Improve your technique

Editing movie film

The creative part of movie making does not come to an end when you take the film out of the camera—the process of editing is equally important, and can be just as rewarding as actually shooting the film

Tessa Musgrave

In the cutting room *By changing the order and length of the shots, the professional movie editor plays a vital role in shaping the pace, rhythm and meaning of the film*

To the uninitiated, movie editing seems routine and tedious—just a matter of cutting out the bad parts, and splicing several short reels into one long one. But, there is much more to editing than this—in the film industry the movie editor plays a vital part in the creation of a picture. Skilled editing can sometimes salvage a good film from disastrous footage, or produce a coherent story from jumbled and apparently disconnected sequences.

One of the basic aims of movie editing is to ensure that the movie 'tells a story'. People expect to see a narrative unfold on the screen, and it is important to make sure that they are not disappointed. You should also try and give your film a natural flow and rhythm so that you cannot see the joins—good editing never draws attention to itself but bad editing always does.

Shooting for the edit

Think about editing before you even shoot the film and, while you are filming, you should always have a general idea

Using cutaways *Breaks in continuity can be disguised with cutaways. For instance, in this sequence, the filmmaker shot only the start and finish of the cavalry parade, and was able to hide the join between the two shots by splicing in a cutaway of the crowd watching. Without this, there would have been a sudden, disturbing jump between shots*

S. A. Jones

of the kind of sequences you want to include in the final movie. This can help enormously when you come to edit the film. If you have a carefully worked out plan with a list of all the shots you want, you should not find yourself in the editing room with a vital sequence missing or without the linking shots that give the movie its polish.

If you are shooting a fiction piece, then a well planned story board is essential (see page 1096), but even for a spontaneous family gathering or for a documentary film, you must have an idea of how the film will look. Always be sure to shoot slightly more footage than you actually need. At public events, for instance, as well as covering the main action, look out for interesting incidents that might complement the main theme of the film. Such shots are really useful when cutting the film together—not only do they add another dimension to your film, but you can also use them to quicken the pace, or to jump forward or backwards in time.

Make sure also that you shoot enough 'cutaways'. These shots are invaluable in maintaining continuity of action. For example, if you are filming at a carnival parade and a brass band is leading the procession, you might be filming the band from the side of the road. In your finished film you may only want to show the beginning and the end of the band going past. If you just film the beginning and the end of the marching band and cut the two takes together, the film will probably appear to jump suddenly forward—certainly the music would be very difficult to match in. However, at some time during the day you may have the opportunity to film some children waving flags and enjoying themselves—without the camera seeing what they are looking at—and this could be cut in between the two marching shots of the band leading the procession.

Skills learnt in editing can help you to be more concise and careful with the camera. Once you have edited a few of your own films your shooting will gradually improve as you begin to discover which sequences always work, and which are simply a waste of time and film.

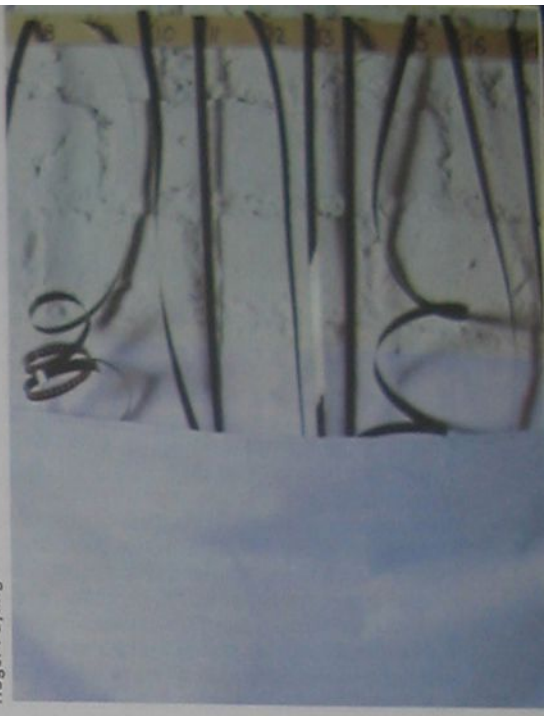
Editing with care

There are two important points which demand caution when editing your movie: making unwanted cuts and damaging the film. Unwanted cuts in Super 8 are a problem because frames are always lost when a cut is made. If you decide after cutting and splicing the film that you want to put the film back as it previously was, you will have lost several frames, causing the action to jump in a disturbing manner.

Because of its small gauge, any scratch or blemish on the Super 8 original is magnified to a large degree. So it is important to handle film as little as possible and work in spotless conditions to minimize damage.

Before you begin to edit a film, run it through the projector a few times to familiarize yourself with the material available, and write a description of those scenes worth including in the final film. Write on postcards or index cards; cards can easily be moved around to change the order of the material—with an ordered list on paper, you tend to assume that the material can only be assembled in the order it was shot. Make a note on the cards of interesting cutaways or individual shots as well.

Once you have written out your edit-cards, sit back and ruthlessly review the footage. It may well be that you have achieved exactly what you had in mind when you planned the film, but it is equally likely that the material bears only a passing resemblance to your storyboard or original idea. If this is the case, you must abandon the idea of fulfilling your original aim, and think carefully about how you can mould the material into a coherent story. Always try to work with your material, never against it—do not try to force your footage into a storyline that does not fit, or your film will look forced and unnatural.



Roger Payling

Film rack *To keep track of each shot, build a film rack using pins with their heads clipped off. A fabric bag stops the ends trailing on the floor*

Once you have decided precisely what you want to achieve, and worked out a new storyline, you can begin to edit the film. Editing normally takes place in three stages: the card edit, the rough assembly and the fine cut.

Card edit Without touching the film at all, arrange the cards on a table in the right sequence for the film, shuffling and reshuffling until the order is just the way you want it. This method of working enables you to think clearly about the structure of the film you are making. You are not concerned with particular details at this stage but with the overall look of the film.

Rough assembly When you are satisfied with your card edit on the table top, it is easy to arrange the film in the order of the cards. Do not get involved in precise cutting of the film at this stage but merely splice together roughly

trimmed strips of film in the same order as the cards. You should always cut the sequences over-long, leaving in the camera starts and stops if you wish. Remember it is the structure of the film you are concerned with. Invariably a few things that you thought would work out on paper do not work out in the film, and it is an easy matter to again rearrange the cards and do a second rough assembly of the film. None of the cuts that you have made are exactly where the final cut will be, so no precious frames will have been lost.

Fine cut Once you are satisfied that everything is in the right order you can start on the final edit. Again, if you are unsure about cutting, it is probably better to include a few extra frames in your initial cuts so that you can progressively whittle the film down.

Always handle the film very carefully —treat your editing area like an operating theatre. The work area must be clean and a film cleaner should be used to wipe off the rollers, guides and pressure plates of your editor or viewer. Dust is a major hazard to editing Super 8 —keep all windows shut, and if you are hanging up lengths of film make sure that if they fall they land in a clean bag. Cover the film with clean material if you are leaving the editing area.

Make sure that you wind the film slowly in order to avoid 'cinch' marks caused by too much strain on the film, and scratches from static dust forced into the film by tight winding. Do not rewind the film through the sprockets of the editor unless you need to view—remove it from the editor gate instead.

If possible handle the film with white cotton gloves—if you find that this makes you clumsy, try wearing just one glove on the hand that you usually use to touch the film. Finally, never smoke, eat or drink at the editing table.

Improving editing technique

A good way of learning how to edit is to watch a few television films with the sound switched off. Without the flow of sound to disguise the cuts you may find it easier to work out how the film is put together. You will notice for example, that in order to show that someone is looking at a particular object, there is first a shot of their face looking, followed by a shot of the object observed, then quickly followed by another shot of the viewer. This leaves the audience in no doubt about what is going on.

This example shows how the juxtaposition of three shots can convey a meaning not present at the time of shooting. In fact, the shots of the observer and the object observed may have been filmed weeks apart and in locations on opposite sides of the world.

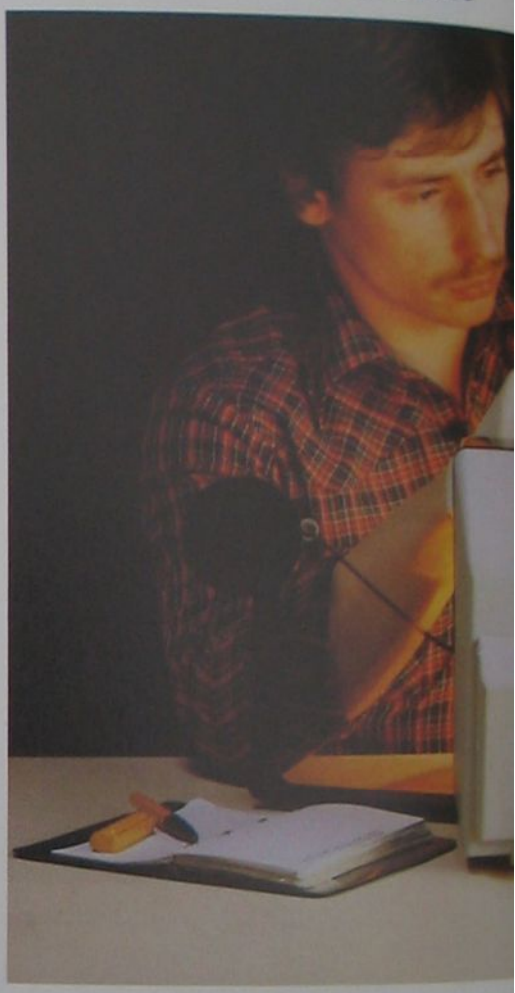
To teach yourself how to take advantage of such juxtapositions, try constructing a story that has *parallel action*—that is, two elements of a story that are happening at the same time. For example, if you are making a record of a day out at the seaside, and you and your family are travelling there by train, you need not present the final film in chronological order. It is possible with careful editing to present the story in a slightly more exciting form.

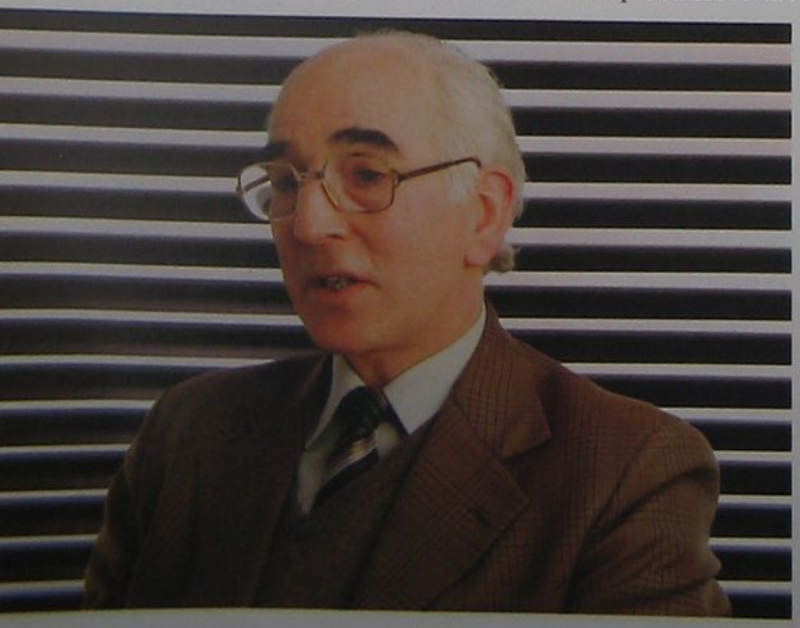
Start off with a wide shot of the interior of the railway carriage, to show the mother and child looking out of the window. Then cut to their point of view—say, a shot of the passing countryside going by. A rhythm of telegraph poles going past could be established, followed by a cut back to the mother asleep in the carriage. A cut to waves lapping on the sea shore, and then back to the mother asleep inside the railway carriage, indicates that she is dreaming of what is at the end of their journey.

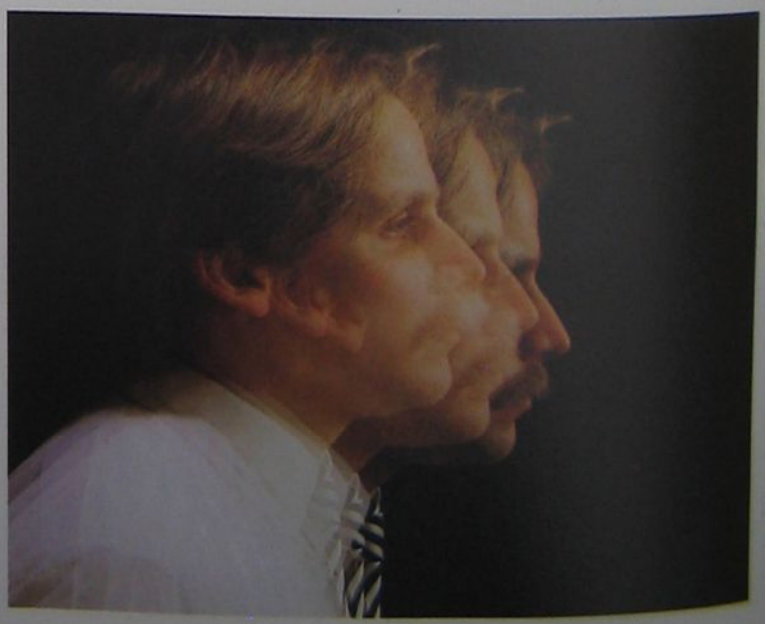
Such is our exposure to the language of film through television and cinema, that it is possible to make such assumptions about the effect of juxtaposition. From the shot of the mother's sleeping face it would be possible again to go forward in time and show other aspects of the day ahead. Cutting pleasant scenes next to shots of the mother smiling in her sleep reinforce the link.

One of the most common faults when first attempting to edit is to cut the material in very short jumpy scenes. This is very disorientating to the audience. The images must be on the screen long enough for someone who is not familiar with the material to be able to understand what is going on. An over cautious approach—holding shots for too long—must also be avoided as it makes the film look 'slow' or static.

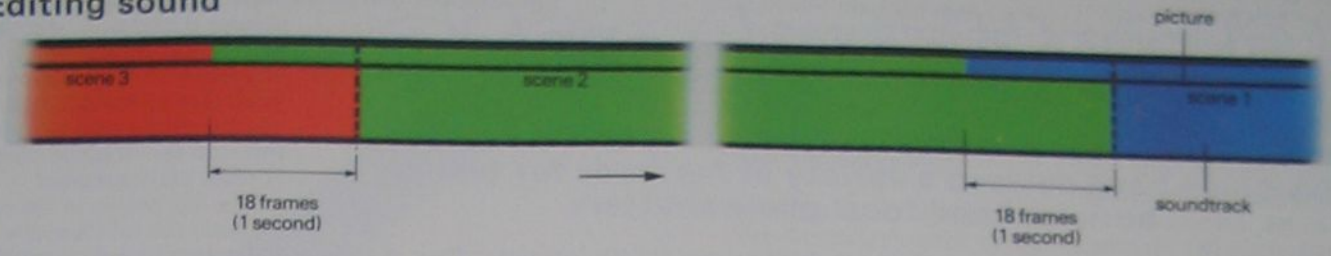
The duration of each scene affects the rhythm of your film. If you have three short shots followed by a long one, the fourth shot tends to take on much more







Editing sound



If you use striped Super-8 film, editing is complicated by the fact that the sound is recorded 18 frames before the picture. This means that when two shots are cut together, the sound changes a second too soon

Advertising Arts

White gloves *Keep the film scrupulously clean when handling. Dust and grit can cause scratches which are greatly enlarged on projection*

importance than the previous three. If this is your intention, then the rhythm of the four shots is correct, but if the fourth shot has no more significance than the other three, your audience will be misled into giving it more value than you had intended.

Special care should be taken when cutting into and out of panning shots. It is generally unwise to cut from a fast pan to a static shot and vice versa. However, it is sometimes possible to do such a cut if the static shot has fast moving objects such as cars or running figures going through the frame. As a general rule, cut the film where the subject begins to move—as a person gets up from a chair, for instance.

The size of image and any change in angle of a shot should also be considered. Cutting between two disimilar shots of the same subject works well, but the situation is more complicated when both shots are almost identical. In television news interviews, the use of the 'noddy' shot—a shot of the interviewer listening—is often used to overcome this common editing problem, proving a break between two similar sequences of the interviewee. The person being interviewed is usually filmed in medium close-up—head and shoulders—and such a shot is often held for the duration of the interview.

When the time comes to edit such an interview, there are inevitably boring sequences which must be removed. If the editor simply cuts these out, and rejoins the free ends of film, there is a noticeable jump on the screen because the camera angle and image size has not changed. So between two similar shots of the person being interviewed another shot of the interviewer is often inserted. This shot of the interviewer apparently nodding to acknowledge what is being said can be filmed days or weeks after the meeting actually took place—even at a different location.

Roger Payling

The 'noddy' shot *The beauty of editing is that you can join together bits of film which were shot quite independently. During this interview, the cameraman zoomed out for a wider view, but the editor decided to use only the beginning and end. The join was concealed by shooting a few seconds of the interviewer nodding, and splicing it in*

Editing sound film

All super 8 sound cameras use single system filming—both sound and picture are recorded on the same strip of film. However, the picture, and the sound that corresponds to it are separated by 18 frames. This represents a separation in time of one second at normal projection speed. This separation is needed because of the different requirements of film and sound recording. To make the exposure, the film must move intermittently, but for sound recording, this jerky motion must be smoothed out into a constant flow. An 18 frame loop of film between shutter and sound head accomplishes this smoothing.

In editing, the practical consequence of this separation is that if the film is cut and rejoined, the sound cut occurs a second before the picture changes. This can seem disconcerting if the image and sounds are radically different before and after the cut, but there a couple of precautions you can take to avoid problems.

The first of these is relevant at the time of filming—always try and leave a second or two of silence at the beginning and end of each take. This makes cutting considerably easier.

When you come to edit the film, listen carefully to the sound at the *beginning* of each scene, and make the cut where you think the sound should start. At the end of the sequence, look at the *picture* when you are trying to decide where to make the cut. If you follow these simple rules, the delay between picture and sound should be unobtrusive.

Understanding...

Shutter tests

In the search for ever more accurate exposure, camera designers have devised a variety of methods for testing both leaf and focal plane shutters

Unless something goes drastically wrong, people rarely question the accuracy or consistency of their camera shutters. Fortunately most modern cameras have shutters which are very accurate, and small errors—such as a shutter giving 1/220 second instead of 1/250—have little or no effect on the final picture. Nonetheless, manufacturers seeking to improve performance need some means of determining shutter accuracy and for this a number of tests have been devised. Similar tests are also used to check shutters after or preceding repairs.

Leaf shutters

One of the simplest methods for testing leaf shutters is to use a photocell—similar to those used in light meters—placed behind the shutter. This is often called the *integrating* method. The cell is connected to a voltmeter and this measures the total amount of light passed by the shutter at a particular speed, which can then be compared with the amount which should be transmitted. In this way the effective exposure time (see page 1748) is checked, though this method tells nothing about efficiency and total open times.

In an extreme case, a shutter set at 1/500 second might be found to give correct exposure to the film. But if its efficiency is very low—say 30 per cent—the total open time would be 1/150 second. This means that, although the pictures would be correctly exposed, the action stopping capability of the camera would be much less than the marked speed suggests. In particular, bright highlights on rapidly moving subjects would tend to be blurred as they expose the film throughout the opening and closing time.

A more sophisticated method of testing involves a *cathode ray oscilloscope*, which is similar in some ways to a small television set. A bright dot moves across the oscilloscope screen tracing out a graph or pattern, and the shape of this pattern is analyzed to provide a range of information. With the oscilloscope connected to the photocell, all the important shutter characteristics—effective exposure time, total open time and efficiency—can be measured. The trace on the oscilloscope usually glows for a second or two, but for detailed study it is often photographed.

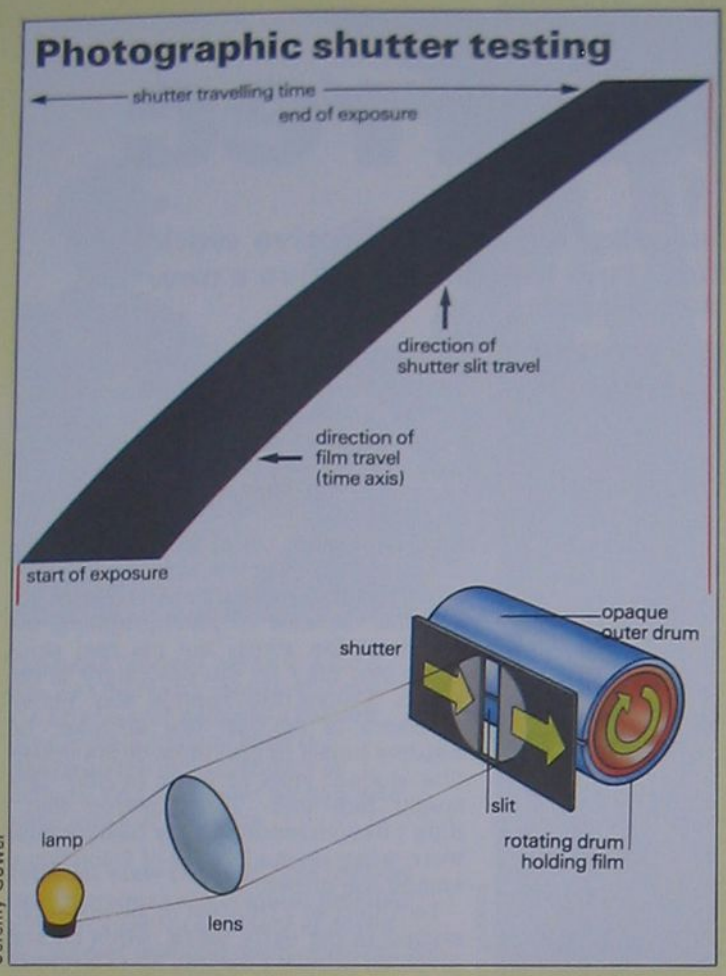
The test set-up is the same for both the oscilloscope and the integrating methods. Collimator lenses (see page 1075) are used so that the light passing through the shutter is parallel. This is diffused and the overall light level (intensity and time) is measured by the cell.

Focal plane shutters

The testing set-up is similar for focal plane shutters except that a slit is placed in front of the shutter. This slit is very narrow and is placed parallel to the shutter slit (at right angles to the direction of travel of the shutter blinds). In this way the light which is

Frozen buggy *The camera's top speeds must be accurate if you are to be sure of freezing fast action*

Richard & Sally Greenhill



Jeremy Gower

Photographic method *Film held inside the rotating drum produces a trace (top) when it is developed. A range of information can be calculated from this trace, such as accuracy and the shutter travelling time*

measured is that falling on one point of the film. This is important with focal plane shutters as the effective exposure time relates to one point on the film rather than the whole film as with leaf shutters. By moving the slit the effective exposure time can be measured for different parts of the film plane to see if it is consistent across the frame.

Photographic testing

In addition to these electronic test methods there are many methods for focal plane shutters which involve exposing film. One of the best uses a revolving drum made of transparent plastic inside which a strip of film is placed. The drum is inside a light tight housing. This in turn has a slit about one millimetre wide running the whole length of the drum.

The shutter to be tested is placed as close as possible to the slit in the housing, the camera lens having been removed. The direction of the shutter travel must be parallel to the slit (which is parallel to the axis of the drum). Illumination is provided by a lamp placed about one metre from the shutter.

The drum is rotated using a variable speed motor at speeds between 60 and 4000 revolutions per minute, the exact speed being chosen to suit the shutter speed under test. When the drum is revolving at the correct speed, the shutter is tripped. Afterwards the film is processed to reveal a trace similar to that shown in the diagram. Once the linear speed of the film in the drum has been calculated, this trace can be used to show all the characteristics of the shutter.

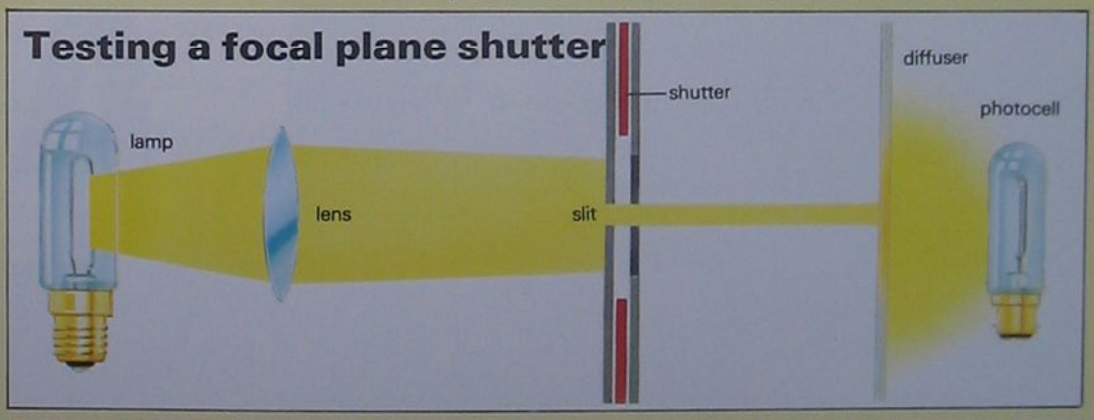
One advantage of this method is that it gives the *total travelling time* of the shutter. This is the time taken for the complete shutter operation, that is, for the slit between the two blinds to travel the focal plane. This is important in flash synchronization, particularly with flash bulbs (see pages 1218 to 1219). This is because the light from the bulb must be maintained at approximately the same level during the whole time the film is being exposed.

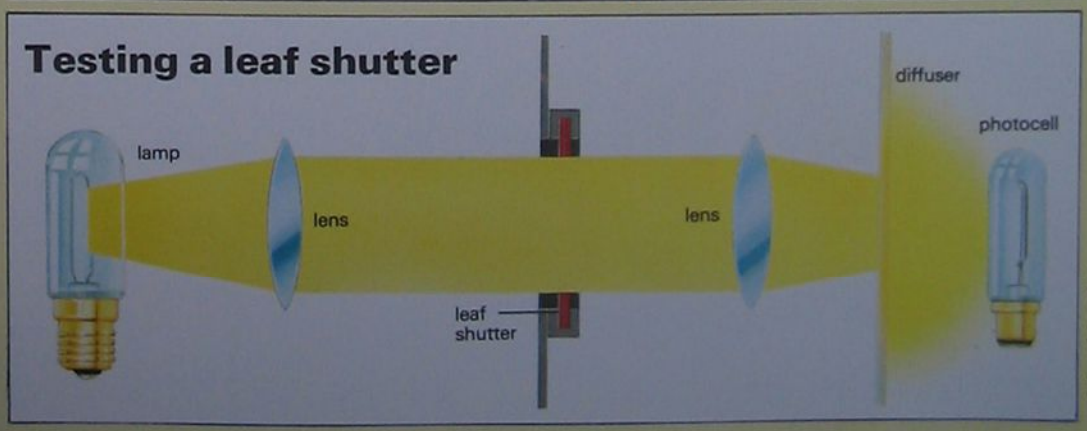
The travelling time is shown by the total length of the trace measured along the time axis. In the case of a 35 mm camera with a horizontally run shutter, the travelling time is often around 15 milliseconds. This means that with a shutter set to 1/1000 second, although each part of the film is exposed to light for this very short time, the total time during which film is being exposed is 15 milliseconds, or around 1/60 second. In fact, this travelling time is often constant for all speeds from 1/60 second and faster.

The way in which one part of the film is exposed before the others can lead to distortion with rapidly moving subjects. A speeding car travelling across the field of view is elongated or shortened depending on whether its image is moving in the opposite direction to the shutter travel or in the same direction.

With a vertically run shutter the travelling time is shorter as the blinds have less distance to travel. The exact travelling time depends on the design of the shutter so the test method described, and other similar methods, are useful to manufacturers who can use the information provided to determine flash synchronization speeds.

Electronic testing *The most common test methods use photocells to measure the amount of light, coming from a standard source, which is passed by the shutter*





Advertising Arts

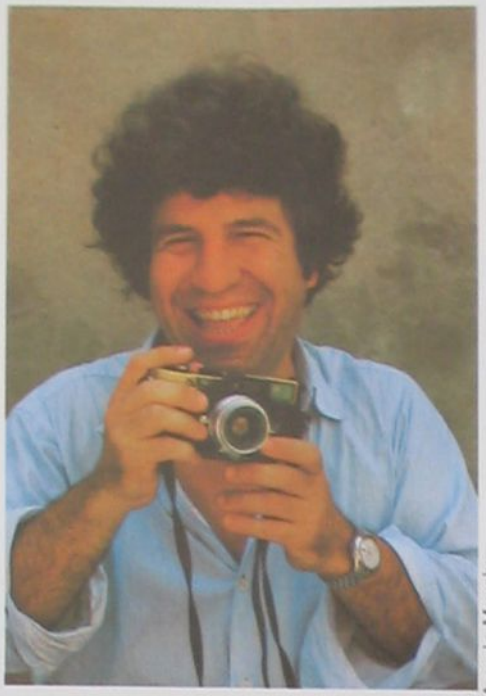
Guy le Querrec

Guy le Querrec is a French photojournalist whose distinctive work shows an ever present sense of humour and his ability to give a new twist to everyday subjects

The warm and engaging images taken by the French photographer, Guy le Querrec, have placed him in the top ranks of documentary photographers. Working in the tradition of some of the greatest photographers of 20th century life, such as Henri Cartier-Bresson and Robert Doisneau, le Querrec, now just 40, has taken an amusing and often poignant series of black and white photographs documenting the everyday life of the French bourgeoisie. He is also justly famous for his pictures of some of the world's greatest jazz musicians.

Le Querrec's best pictures are distinguished not only for their feeling for everyday life but because they make us laugh at some of its absurdities.

Actions are caught at just the precise moment. A flag blows into a trumpeter's face during a performance of the local band, a cow at auction is caught eyeing the telephone hopefully and some telling expressions appear on the faces of campaigning politicians. But the humour that fills these images is always human and affectionate, never malicious.

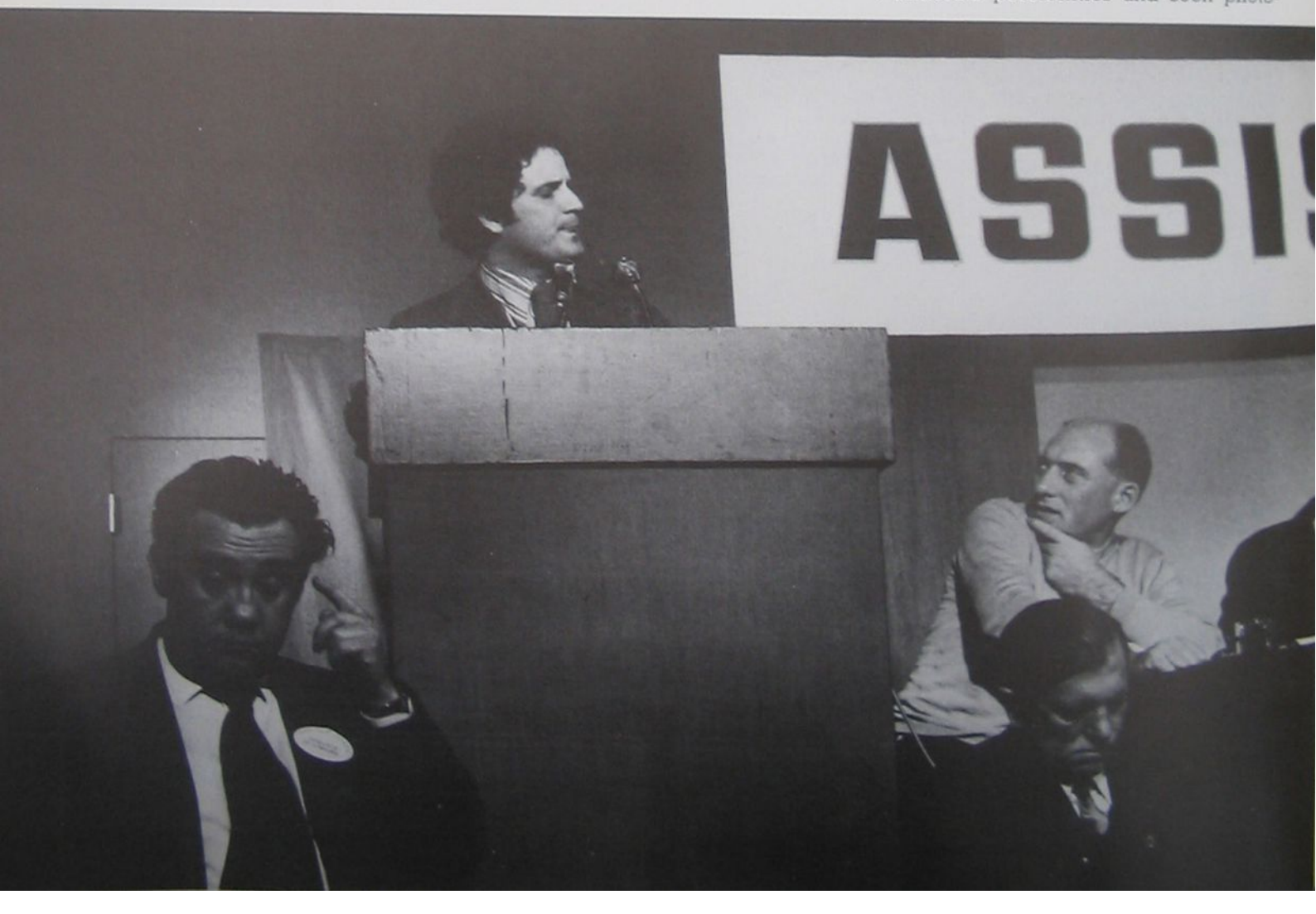


Angela Murphy

In all these situations le Querrec has shown his command of a vital photographic point. He has anticipated the action so that when it occurred he had his camera at the ready, his finger poised on the button.

Le Querrec's talent for capturing the mood of everyday life also shows when he is covering more dramatic events. He is quite capable of photographing the centre of the action but his real skills come into play on the periphery of the action. Unlike the famous war photographers of the last few decades, he dislikes being in the midst of the action. The student riots in Paris in May 1968 taught him that. 'I discovered that I didn't like violence. All my best pictures were taken on the fringes of the action—among the crowd.'

Le Querrec's interest in photography started in his early teens, when he was given an Ultraflex camera as a Christmas present. He was delighted with the camera's possibilities and soon photo-



The band (*above*), *taken at a local fete. Le Querrec's wandering eye has a genius for noticing a bizarre sight in the middle of what is otherwise the most ordinary of settings. This particular picture was taken with a 35 mm lens*

Political view *October 1974* (*below*) *Party members at a Socialist meeting in Paris caught in a variety of poses. Le Querrec watched them, studying the way they interrelated, then took pictures as their gestures coincided*

graphy became a consuming interest. By the time he was 19 he had acquired a Rolleiflex and wanted nothing more than to enrol in a photographic school.

Unfortunately, his parents did not regard photography as a profession. The idea of college had to be abandoned, and for many years, photography was just a hobby. During this time he married and had a child. Some years later, while working for an insurance company, he happened to read through a series of articles about the 35 mm Leica. Attracted by its compactness and versatility, le Querrec decided to buy one. The result was dramatic.

His previous pictures, taken on the Rolleiflex, were unexceptional. But with his new Leica he began taking pictures in quite a different way. At first, he concentrated on taking pictures of his own life and family and gradually developed a highly personal style. With the small, manageable Leica, photography could be far more spontaneous and he began to take many funny, touching and revealing candid shots.

Within a few years, le Querrec had found himself a job as an in-house photographer at a publicity agency. And a short time later the magazine *Jeune Afrique* (Young Africa) sought him out after seeing one of his pictures in an exhibition about the student protests in Paris in May 1968. Six months later he was working for the magazine full-time and stayed there until May, 1971.

It seemed to le Querrec very much a matter of chance—the journalist from *Jeune Afrique* just happened to like his photo. 'It wasn't a very good photo. I didn't particularly like it then, and I still don't. But perhaps if I hadn't taken that photo I would never have come across *Jeune Afrique*, and the coin would have fallen the other way up.' This is typical of Le Querrec's 'take it or leave it' attitude to life. To him, life is like 'tossing a coin' —sometimes you win, sometimes you lose.

His introduction to the famous photo agency Magnum seems to him to have been similarly lucky. 'My pictures happened to be developed and printed in the same professional laboratory that Marc Riboud used (see page 964). He went there one day to have a look around, saw my photos and wanted to meet me.'

Subsequently Magnum distributed a number of le Querrec's stories, and four years later he was accepted as a member of this world famous cooperative of photojournalists. Before this, however, he helped to set up a similar cooperative with five other photographers in January, 1972. They called the agency 'Viva'.

'I was with Viva for four years altogether and it was a very interesting experience. All the subjects that we covered as photographers were those which we had always wanted to cover but never had the time. Now we did.

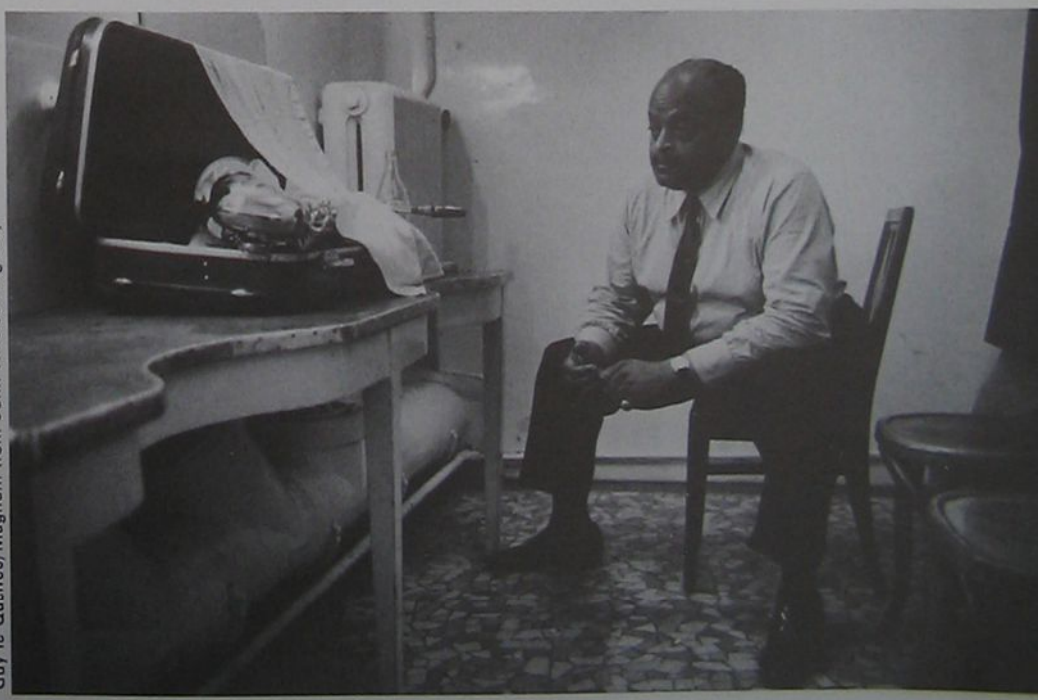
'One of Viva's innovations was to have people working on reportages collectively. One of our most successful joint projects was an exhibition called *Families in France*. It seemed to be difficult, at that time, to find photos which, without necessarily being ''sociological'', portrayed everyday contemporary life.

'The project dwelt on the family, showing that the family as an insititution is no longer very successful—that men and women are no longer always faithful to each other for a lifetime, even if they have children—that there are other ways of looking at relationships. We wanted to show these ''cellules''.'

'Each photographer attempted this fairly successfully. Although it wasn't always that easy for us because our own family lives were not always the greatest success themselves . . .'.

The cooperative clearly demanded a great deal of personal involvement and they were continually questioning themselves on the aim of photography and

Ben Webster, *the tenor saxophonist, was waiting before a concert in the Salle de la Mutualité in Paris, when le Querrec took this picture, which so clearly captures the loneliness of backstage life*



Guy le Querrec/Magnum from John Hillelson Agency

The father of the bride, *June 1975. One of a series of pictures taken over five weeks for a major exhibition on life in the Parisian suburbs. Le Querrec was one of six photographers chosen to take pictures for the Centre Beaubourg*

the way pictures were used in the media. Naturally, personal values came to the fore and differences became apparent. Le Querrec himself became preoccupied with different ideas to the others and eventually found the set-up so claustrophobic that he decided to leave.

'It was very difficult to leave Viva having been one of its founding fathers—it was like leaving a child. And I still feel that the agency opened a lot of doors for French photography.

'It was very democratic in the way that it let people approach their own society through photography without having to spend all their time on scoops or reportage. It seemed to wake up some of Magnum's old traditions at a time when Magnum had probably become too accustomed to what it was doing.'

In 1976 le Querrec was himself accepted by Magnum—first as an associate and later, in 1977, as a full member. Le Querrec continues to work on personal projects whenever possible and in 1976 he was awarded the first of a number of government photographic grants—to photograph *The French on Holiday* for a subsequent exhibition.

Among his other sponsored projects on French everyday life have been projects undertaken for the Parisian cultural centre (Centre Beaubourg) on youth and on suburbs—for this he chose to look at his own roots.

Bretons, particularly have provided him with some of his best material, including photographs that he has taken for a book that he would like to do on Brittany itself. If ever le Querrec has a spare moment this is the place that he usually heads for.

Another area that has proved a particularly fruitful subject for le Querrec is jazz. His now celebrated series of portraits of international jazz musicians was started out of a deep love for the subject combined with a fascination for the day-to-day realities of a jazz musician's life.

'I am very interested in music as it seems to me to be very close to photography. I am fascinated by the very special life style of jazz musicians. They live a life of constant movement—like Alpine herds of sheep and cows that are always on the move between the winter pastures of the valley and their summer pastures, high up in the Alps. And I am interested in the contrast between this essentially lonely lifestyle where they always seem to be in exile and their stage life where they are the focus of attention for crowds of people!'

This series produced such appealing pictures as his shot of the great American bass player, Charlie Mingus, head obscured, as he wheels his giant double bass on a trolley through Nice Airport. The loneliness of backstage life is also captured in le Querrec's portrait of tenor-sax player Ben Webster sitting in his dressing room, solemnly composed, before a Paris concert.

Le Querrec still pursues his interest in jazz, selling his photographs mainly to the small specialist jazz magazines and recently, doing a long term project for the Ministry of Culture on the clarinettist, Michel Portal.

'There aren't many photographers who work much for small magazines, those with a small circulation—about 25,000 copies in France. But I've done a lot of work for small magazines. I enjoy it, and they actually reach a lot of people. It was said that for every copy of *Jeune Afrique* that was actually bought, there were 50 readers. So the magazine must have been read by about one and a half million people.

'Also on a small magazine there's usually a better rapport with the art director. You discuss things more and come to mutual agreement about how a particular story should be approached.'

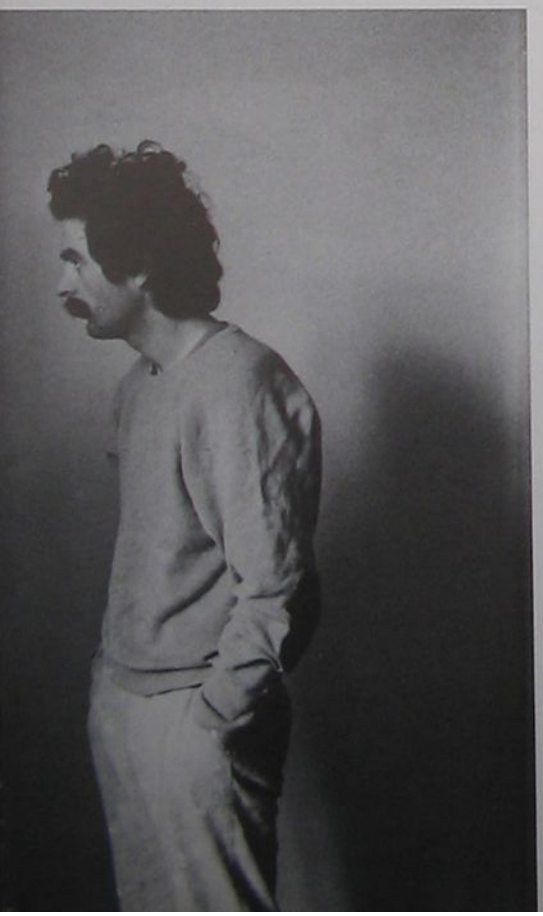
Le Querrec continues to work on assignment for a variety of small magazines as well as the major European weeklies—*Stern* in Germany, *Epoca* in Italy and *Paris Match* in France.

Since 1976 he has also found himself in demand as a teacher at a number of photographic workshops throughout Europe. He enjoys teaching. It satisfies his strong desire to communicate his ideas about photography.

Guy le Querrec/Magnum Photos

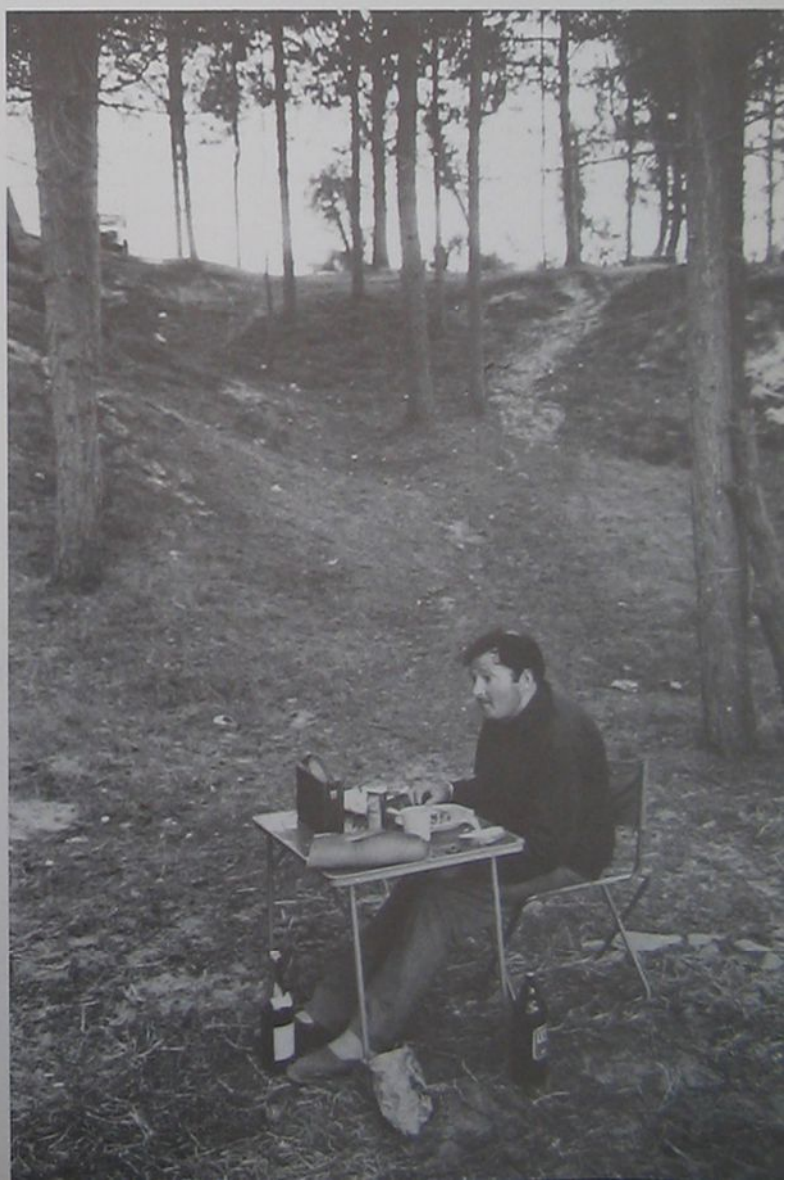
'There are photographers who don't like to talk about what they do or what is happening, but I like being able to do this. I really like to be able to go back to my own roots as a photographer. I found it very hard to become a photographer. It's not easy. Being able to work with others and help them to take short cuts makes up for this.'

Charlie Mingus
August '76 (above). An unusual view of the great bassist taken at Nice airport as part of a personal project which focused on the constantly moving lifestyle of a number of jazz musicians



Woman at work
(left) An amusing portrait taken during 'Viva's' first collective portrait on families in France. Here the man is watching his mother decorate. Le Querrec spent three weeks living with the family and photographing them

The camper
A solitary picnic snapped in Brittany while le Querrec was doing a story about the French on holiday, for the Ministry of Culture, during a month-long assignment



The discovery that he enjoyed teaching was an important point in le Querrec's career. He gave his first courses at the famous Arles summer workshop in the south of France. He tried to make his students understand that good photography is not just a question of mastering technique but of being aware.

'I realized that I was trying to give my students some kind of key to open a new door in their lives. You don't always notice doors in a room straight away particularly if the door is small. Yet this may be the most important door of all.'

The popularity of his courses testifies to le Querrec's success at getting his students to find their own new 'door'. Le Querrec also enjoys the fact that his courses are not just attended by aspiring professionals, but by many amateur photographers who simply want to develop their eye.

'That's an attitude I like. I think it's a shame that people can't have the same sort of feeling for photography that they have for music. One loves music, one goes to work and then one comes home and plays the piano. Why do you have to turn professional when you are quite happy earning your living in another way already?'

Le Querrec himself still finds it vital to preserve his freedom of expression, and to continue to photograph the subjects which he feels closest to. Nevertheless the future is an open book and that is how he likes it.

He hopes to continue doing long term projects from time to time, and even to travel a little more. But almost inevitably he will continue to concentrate on photographing people. 'But', he adds, 'of course, you never know. I may come across some beautiful tulip in a magnificent vase one day. I don't want to say that still life is not for me. It's just that, at the moment, if I am not with people I feel I am missing out on something . . . .'

Checking the sound *In reality, this man was checking the static on a record after it had been run through an antistatic device at a commercial sound exhibition*

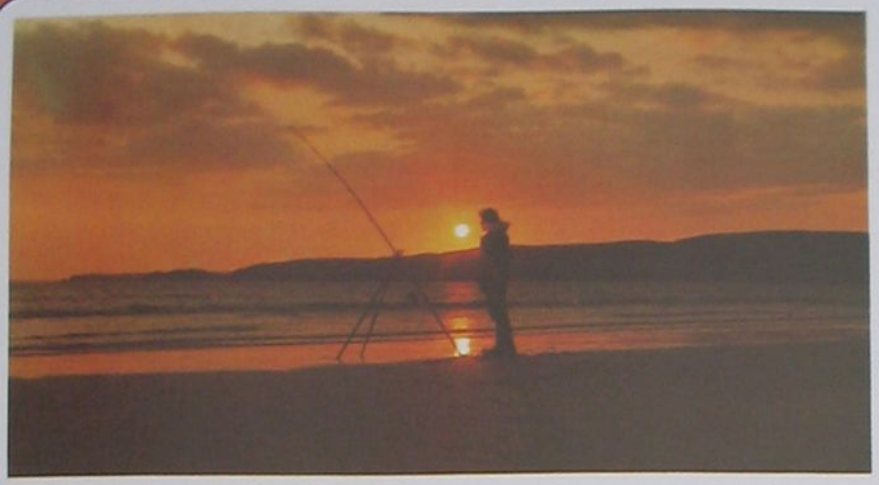
At the Plouescat races *A strange view (below) of four spectators at the horse races held in Kernic Bay in North Finisterre, Brittany—one of Le Querrec's favourite locations*

Guy le Querrec/Magnum Photos

What went wrong?

Sunset on the water

Every sunset cries out to be photographed—but the results are often very unoriginal. Here Sergio Dorantes analyzes some typical examples

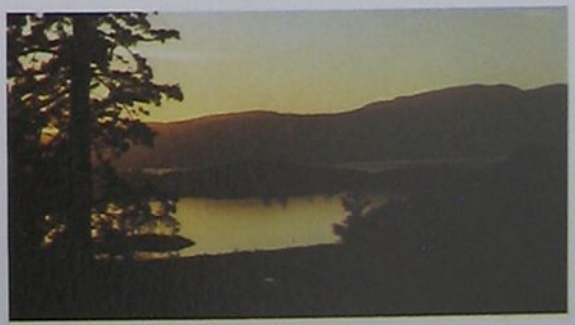


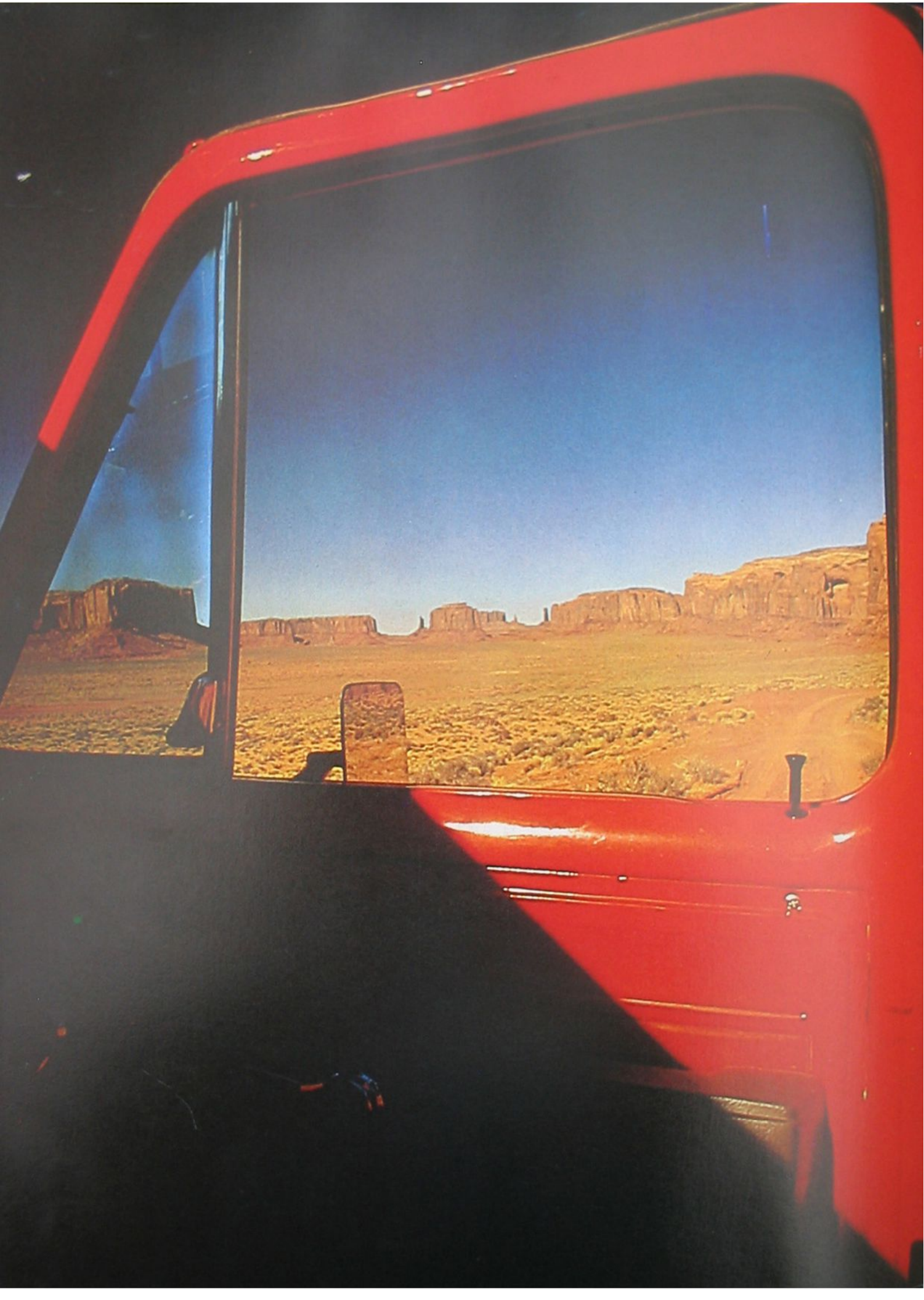
This is an interesting subject, but the centralized composition and the direction of view are not ideal. A shot like this usually evokes a sense of loneliness and space—but framing is important. The horizon has split the picture, giving equal importance to sky and foreground. The sky could have been emphasized, to give a sense of space and make the figure appear smaller. And by positioning the sun on one side of the frame and the figure on the other, composition could have been balanced. All this can be done with a little patience and selectivity

Everybody likes a good sunset, but here little thought has been put into the shot, giving a somewhat uninspired composition. Though the lighting is evocative, there is no point of interest. The photographer could have included something in the foreground, such as a boat or the bank itself, to balance the composition and produce a sensation of depth. The sun's position on the water is not effective—a central position and a vertical format would have been better. The clouds could also have been given more prominence to create atmosphere

This example shows how easy it is to be deceived by a pretty subject, producing a poor shot instead of one which does justice to the scene. The horizon, an important element, is tilted, spoiling the balance. Shooting from a higher spot would have isolated the island, providing a much needed focal point. If the photographer wanted to include both the mountains and the island, a wide angle or telephoto would have given a more organized composition, and using the backlit background a striking contrasty image could have been produced

Another view of the same island—the exposure is acceptable, but the picture is confusing. Despite the strong focal point—the island—composition is weak. The branch on the left could have been used to frame the island for better composition. A longer lens would have shown less foreground, making the shot shot more immediate, or the tree could have been excluded, leaving just the foreground, island and background for a more interesting image. With scenes like this, it is worth looking for the angle of view which gives the best mood





Assignment

LOCO MOTIFS

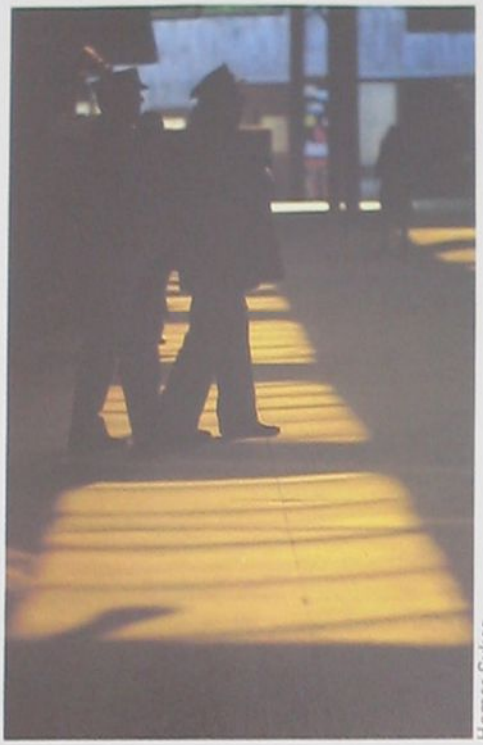
Old fashioned steam railways are not the only trains to have photographic appeal. Homer Sykes found plenty to shoot around a small commuter railroad ferrying New Jersey workers to the edge of New York City

The reality of modern railways, with their sleek featureless rolling stock cutting grimy gulleys through urban and industrial complexes, seems far from romantic—a long way from the age of steam and the excitement of early rail journeys. But, surprisingly enough, some remarkably pleasant, even lyrical images, can be found in the most unlikely places.

Some of the busiest railroads operate in the industrialized state of New Jersey, ferrying commuters to the island of Manhattan, New York. These shuttles are hardly likely to evoke the same sort of associations as their forebears, but given a thoughtful approach from a photographer, even this relatively mundane sort of transport can be given atmosphere, producing visually pleasing images. This task was exactly the challenge facing Homer Sykes when he visited Hoboken station—the destination for commuters bound for their working day in New York City.

Freezing winter temperatures made Homer's task more difficult, but the clear sky and warm light invested the scene with the extra atmosphere needed to bring life to the dreary expanses of landscape. Homer had this in mind while taking many of his shots—an automobile crossing the rails, or an old-fashioned carriage standing idle and juxtaposed with the modern Manhattan skyline.

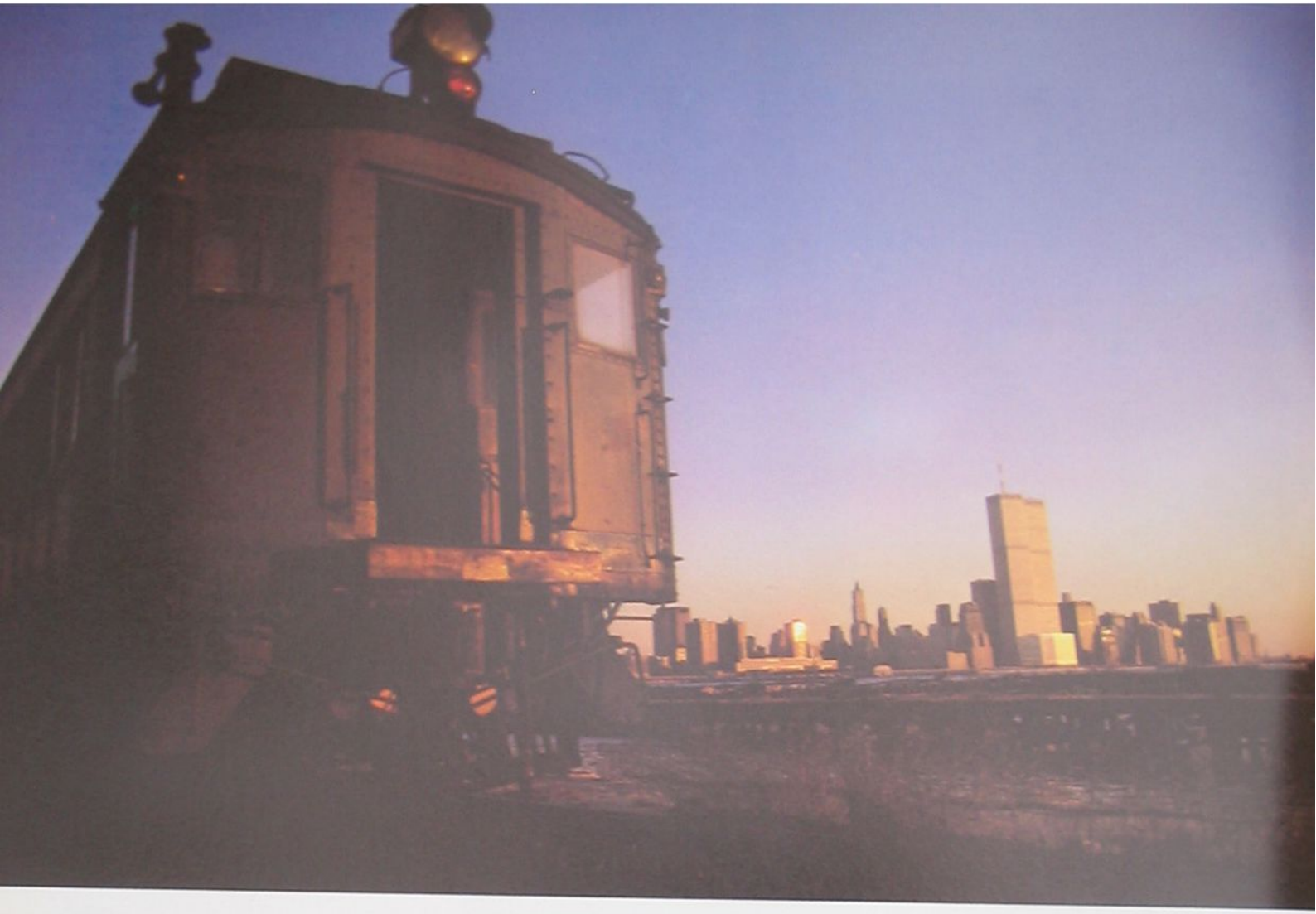
Unlike railway authorities in many other areas of the world, Homer found that nobody paid any attention to his photographic activities. He was free to walk around the sidings, photographing the rolling stock from both outside and from within. Apart from these more static subjects, Homer also photographed the commuters arriving from the New Jersey suburbs to take the subway into Manhattan.



Homer Sykes

Guard *Waiting for the commuters to arrive, Homer made use of the strong early morning shadows for this candid shot. 105 mm lens hand-held at 1/30 sec*

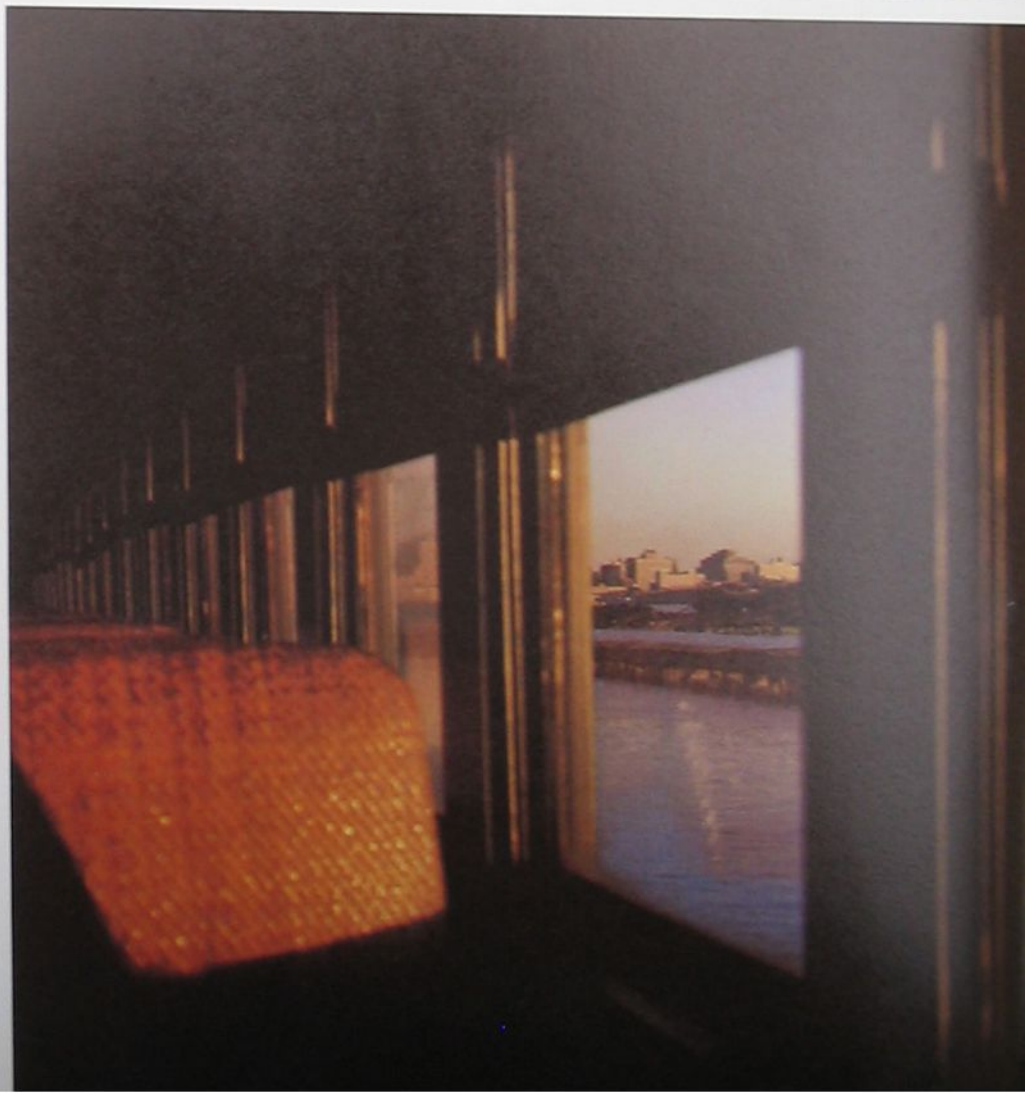
Railroad car *Another shot exploiting the shadows to enhance the subject—this time taken in the afternoon. 35 mm lens, 1/125 second at f/5.6*



To photograph all aspects of this particular railroad, Homer also took a short journey on the train. This turned out to be longer than he had expected because the guard did not want to see Homer get off at the first two or three stops. 'He insisted on taking protective custody over me and was absolutely convinced that I would be mugged if I had got off the train at any of these stops.' Since I had a bag full of Nikon equipment with me I thought I'd better heed his advice.'

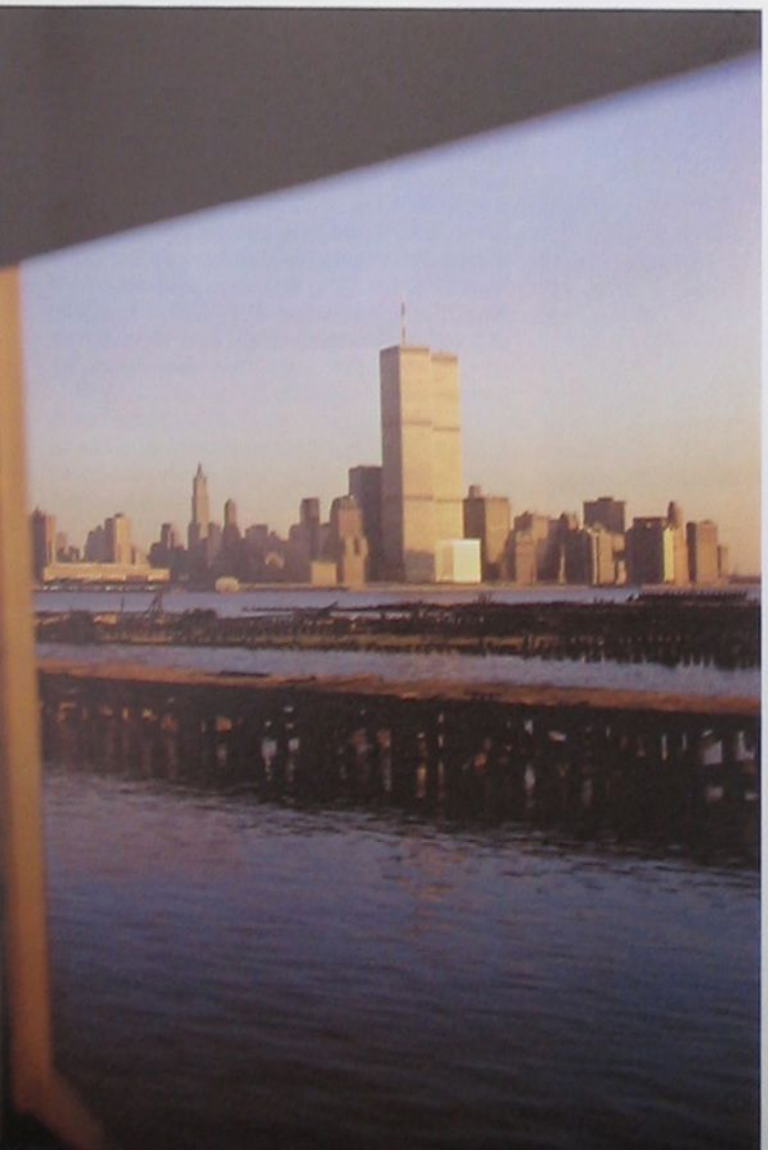
On an assignment of this sort Homer carries two Nikon F2 bodies, both with motor drives, and 24 mm, 28 mm, 35 mm, 105 mm and 180 mm lenses. 'On one camera I keep the 105 mm fitted for photographing people and on the other body I usually fit one of the wide angles. The motor drives are used just to save have to worry about winding on the film, but I also found that they made it easier to hold the cameras when I was working with gloves on. Since it was about minus 30°, gloves were essential.'

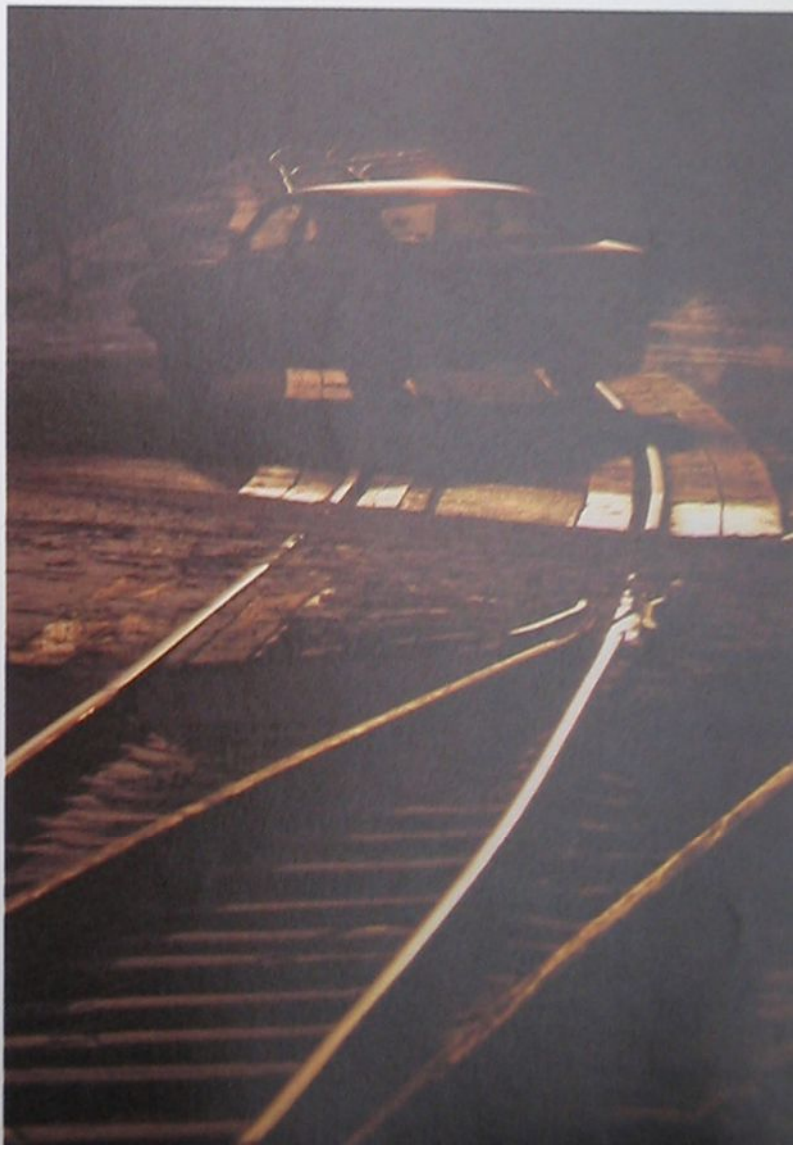
Homer is also sure to carry plenty of film on an assignment—he carries at least twice what he expects to use—just to be sure. This assignment was shot partly on Kodachrome, partly on Ektachrome—both 64 ASA. Homer prefers Kodachrome, but is always wary of processing faults, as he explained, 'I've had rolls of film made unusable by blue dots or magenta stripes—once a whole job was ruined. Now I always cover myself by doing some on Ektachrome.'



Manhattan skyline *(far left) Afternoon winter light was ideal for this shot relating the old commuter railroad car to the modern city skyline—the destination of the travellers. A second version of the same idea (below left) was photographed from inside the carriage—Homer always explores all the different ways of approaching a single subject. 28 mm lens.*
Wheels *Another shot taken in the late afternoon light, this time on Ektachrome EPR. Homer used a low angle of view to accentuate the shapes of the wheels and to make them dominate the frame. 35 mm lens.*
Waiting for the train *Homer finds a 105 mm lens ideal for candids like this. He takes a light reading before he starts framing the shot and rarely asks for permission—until afterwards.*
Car crossing *While driving around exploring smaller railroad towns, Homer drove over these tracks and thought of this shot. Shooting into the sun with a 180 mm lens, he waited for a car to cross the rails catching the sun reflecting off the roof. By shooting into the sun he also caught the light reflecting off the rails as they recede from the camera. Using Kodachrome 64, he bracketed his shots to make sure of satisfactory results—with a shot like this, there is no 'correct' exposure, it depends on the effect that looks best. This exposure was 1/250 second at f/8*

Homer Sykes





Using roll film SLRs

If you are familiar only with 35 mm SLR photography, using a roll film SLR for the first time may seem quite daunting. But they are quite simple to use and offer very high quality, large format images

The advantages of the single lens reflex camera are familiar to almost every serious photographer—it has a viewfinder which shows exactly what is recorded on film, and is compact, convenient and easy to use.

For the amateur, 'SLR' is synonymous with '35 mm', but Single Lens Reflex cameras which use the larger format rollfilm are commonplace in professional circles. These offer most of the advantages of their smaller 35 mm cousins — compactness and convenience and a viewfinder that shows exactly what is recorded on film—but they produce pictures that are four times the size of a 35 mm frame, and have other additional features which make them particularly versatile.

The habitual 35 mm user, however, may find rollfilm cameras clumsy and unfamiliar. They are quite heavy, and with the exception of one camera, none of the controls are where you would expect them to be. Nevertheless, these cameras are easy to use once you get to know them and are ideal for producing big, high quality pictures.

The first step is learning how to load the film. Loading methods vary from model to model—two examples of fairly typical loading procedures are shown on pages 1709 to 1791. Although loading seems complicated when compared to the simplicity of a 35 mm camera, it is a routine which is actually much easier than it looks, and after a little practice you should have no difficulty.

Film can be loaded either with the magazine separated from the camera, or attached to it. You may find it easier to leave the magazine attached to the camera body so that you have fewer pieces to cope with—an important consideration if you are standing ankle deep in mud.

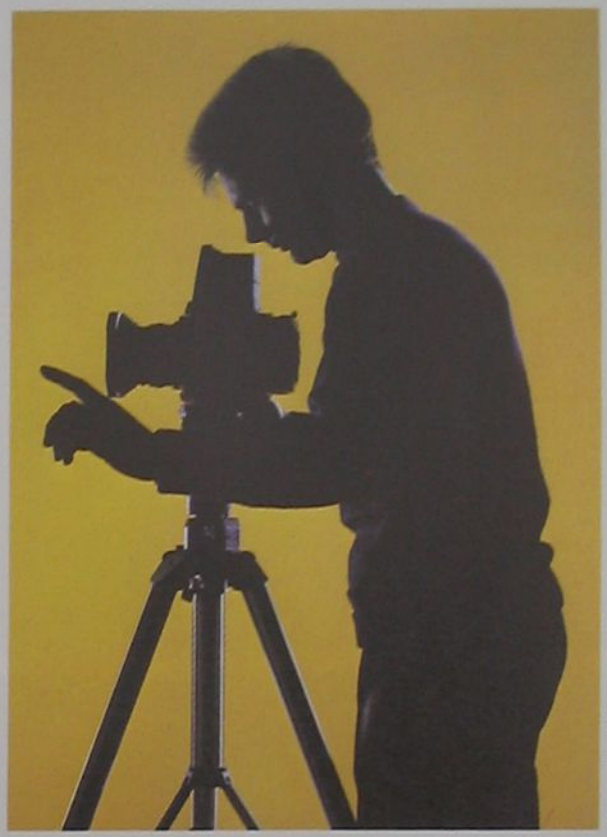
Cameras that have removable magazines invariably have a film shield—a stainless steel or plastic blade that prevents the film being fogged when the magazine is separated from the camera body. Most of them also have safety interlocks which prevent the shutter from being fired when the shield is in place, and lock the magazine to the camera when it is withdrawn. This system prevents film from being inadvertently fogged, and assures that the photographer does not 'shoot' a whole roll of film with the shield in place.

A few cameras have a compartment for stowing the shield when it is not in place in the magazine. If your camera does not have this facility, you should develop the habit of always putting the shield in some safe place—in a particular compartment in your camera bag, for example or in your top pocket—rather than simply stuffed in your back trouser pocket where it will be bent if you sit down. It is very easy to lose, or at least temporarily mislay such a small object, and this can be very irritating if you are working quickly, and want to change magazines.

Changing lenses is a more straightforward process, similar in most respects to lens changing on smaller cameras. All rollfilm cameras have bayonet mount lenses, and these are usually removed by pressing a button and turning the lens. Several rollfilm SLRs have leaf shutters in their lenses, and when mounting or removing a lens on one of these cameras, you must make sure that the shutter in the lens is tensioned, and that the film has been advanced. If you neglect this, you may damage both camera and lens because the coupling is not in the correct position.

Besides advancing the film and cocking the shutter, cranking the wind knob or lever performs a further vital function; it lowers the mirror in the camera body. Unlike 35 mm cameras, few rollfilm SLRs have instant return mirrors. When the shutter release is pressed, the mirror rises, and the image disappears from the viewfinder. If you find this loss of image disconcerting. you should use one of the few cameras that have an instant return mirror.

When you take your first shots on a rollfilm SLR, the first point to consider is how to hold it. This largely depends on the viewing system you are using—the standard fitting on most cameras is the folding waist-level finder. If you are using this, you should support the camera with your left hand, so that your left index finger rests on the shutter release button. This is usually on the front of the camera at the bottom right. You can then use your right hand for focusing and winding film. The Rollei SL66 is awkward to use because the lens is focused using a knob on the left of the body, and the film is wound with crank on the right. When this camera is used hand-held, it must be switched from hand to hand as the lens is focused and film is advanced. Bronica cameras present similar problems, because the film speed control is on the left hand side of the camera body.

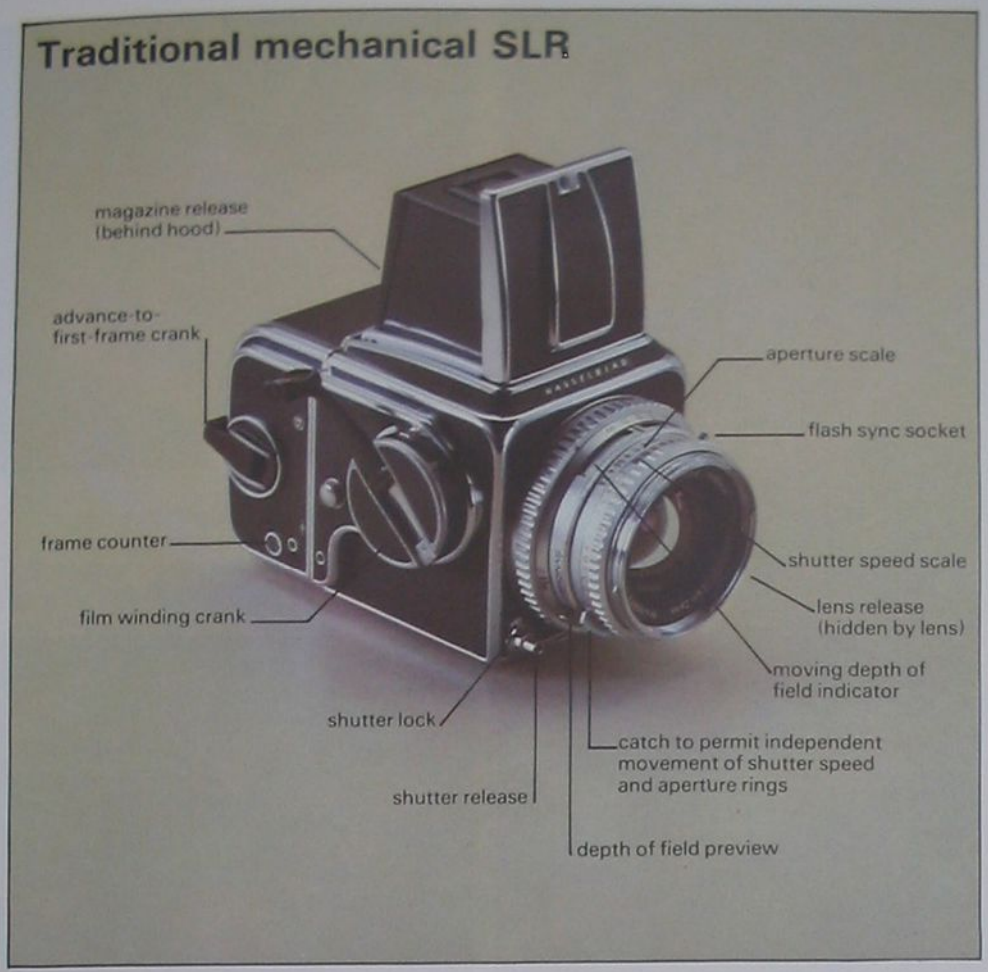


Roger Payling

In the studio *The rollfilm SLR is possibly the ideal studio camera. It is compact and convenient, yet produces a negative four times the size of a 35 mm frame*

Traditional model
The Hasselblad 500 C/M is a traditional, mechanically operated camera, and is shown here with the waist-level finder fitted as standard. It has a leaf shutter, and most of the controls are grouped on or near the lens

Electronic automation
The Bronica ETR is typical of the modern breed of rollfilm SLRs. It too has a leaf shutter, but this is electronically controlled, and the shutter speed dial is on the side of the camera body. This model is fitted with a speed grip, and the metering prism converts it to a fully automatic camera



barrel, or on a panel on the camera side. In order to check on depth of field, you should take a Polaroid test shot and examine it using a magnifier.

Setting the exposure

Controls for setting the aperture and shutter speed are easy to identify by their familiar series of numbers. The shutter speed control is usually on the camera body, and the aperture ring on the lens, but on the Hasselblad, the two controls are on adjacent rings around the lens. These are linked together by a spring clip, which must be pressed if the two rings are to be moved independently of one another. This feature can be infuriating when you want to quickly bracket a series of exposures, but can be useful if you are using fill-in flash.

TTL light meters can be fitted to virtually any rollfilm SLR, but most photographers prefer to use a separate hand-held meter, perhaps because these medium format cameras do not lend themselves to the kind of rapid-fire shooting that demands snap decisions about exposure.

Once you have focused the camera, and set the aperture and shutter speed, you are ready to take a picture. If nothing happens when you press the shutter release, there could be a number of things you have forgotten. Check that you have removed the darkslide, If there is one fitted, and that the film has been advanced to the first frame. Check that

Cameras which use the 6 × 4.5 cm format are generally fitted with pentaprisms, because of the difficulties of using a waist-level finder when the camera is turned through 90° to take vertical format pictures. Holding a camera at eye level can be quite tiring, and you may find that a pistol grip takes the strain off your arms, and makes handling easier. Some of these cameras can also be fitted with a *speed grip*, which has a coupled shutter release and film wind crank, and makes operation much quicker and easier.

With a couple of exceptions, focusing is accomplished by turning a ring around the lens—just like a 35 mm camera. With a waist-level finder, however, you may find it difficult to accurately judge the point of sharp focus. It is best to do this using the flip-up magnifier fitted to the inside of the folding hood—with the screen up to half a metre from your eyes at waist level, focusing without a lens is not sufficiently accurate.

Although split-image and microprism focusing screens are available for rollfilm SLRs, these are not very easy to use (except with prism finders), and photographers generally prefer a plain matt screen.

Depth of field preview facility is available on most cameras of this type, though it is of limited use, because the focusing screen darkens considerably when the lens is stopped down. The depth of field available at any particular aperture is indicated by scales around the lens

Roger Payling

Bookform holder loading

The rollfilm holder of the Mamiya RB 67 is typical of bookform holders—the magazine at the back of the camera opens up like the cover of a book

1 Open back *A catch releases the back cover, and frees the rollfilm holder. This is removed from the magazine for film loading*

2 Lift out spool *A button inside the holder retracts a pin, releasing the film spool. Transfer the empty spool to the take-up spindle*

3 Pull out leader *Fit a new roll of film on the supply side of the magazine, and pull the backing paper across the pressure plate*

4 Line up arrows *Crank the film until the arrows on the backing paper are aligned with the white triangle engraved on the holder*

5 Replace insert *Slip the holder back into the magazine, and close the bookform cover. A latch on the magazine locks the cover closed*

6 Advance the film *Crank the lever wind until it locks. A number 1 appears in the window, and the magazine is ready for use*

Camera couplings *These delicate couplings cock and release the shutter. When changing lenses, they can be damaged if their positions do not match*

the shutter is cocked—though in most cases, if you can see an image in the viewfinder, you can be sure that this has been done. If your camera has an electronic shutter, check that it has been switched on, and that the batteries are not flat. Finally, check that there is not a catch which locks the shutter release.

If you are making an exposure which is longer than 1/15 second, keep the release depressed until the shutter has closed. This is important, because on models of cameras which utilize a leaf shutter, there is an auxiliary capping shutter in the camera body. This shutter closes the instant that you take your finger off the release button, and it can easily close before the primary shutter in the lens, thereby curtailing the exposure prematurely.

Rollfilm SLRs which have leaf shutters offer significant advantages with electronic flash, because there is no upper limit on the speed that can be used (see page 1218). If the camera you are using has a focal plane shutter, you may be limited to speeds slower than 1/60 sec. This is such a severe limitation that the manufacturers of these cameras have made available accessory lenses which are fitted with quite separate leaf shutters, so that flash can be synchronized at all speeds.

Special features

Certain rollfim SLRs have controls or features which you may not immediately understand. The most common of these is the facility for changing from 120 to 220 film. In outward appearances, these two film types seem identical, but there are important differences between them. 220 film is twice the length of 120, and to accommodate the longer strip of film on the same size spools, the emulsion is coated on to a thinner base. The backing paper, too, is different. Instead of running the full length of the film, it is fixed to the film only at the beginning and end—a paper tail and leader.

Before loading a roll of 220 film, the pressure plate at the back of the camera

must be moved forward to compensate for the different film thickness, and lack of backing. This forward movement is accomplished by rotating or sliding the pressure plate, or operating a catch. An adjustment must also be made to the frame counter, so that it does not stop counting halfway through the film.

Not every magazine can be used with 220 film—Hasselblad and other cameras must be fitted with a special 220 back.

A feature which you may recognize from 35 mm cameras is the *mirror lock up*. This raises the mirror to reduce vibration when the camera is used on a tripod, and reflex viewing is not required. On Hasselblads, it also closes down the lens to the working aperture, so that the only vibration at the moment of exposure stems from the shutter itself. A further advantage of using this pre-release is that it reduces the elapse between the release and the exposure.

Coloured index *The red and white windows indicate whether film is wound and shutter cocked. To prevent double exposure, the colours must match*

The Rollei and Pentax

Two rollfilm SLRs are quite different from the rest, and have characteristics which make them exceptional. One is the Pentax 6 × 7, which has a layout reminiscent of a 35 mm SLR. It has a focal plane shutter, and an instant return mirror, and many of the comments about camera handling do not apply to it—it is probably the quickest and easiest to use of all rollfilm SLRs.

Another highly unusual camera is the Rollei SLX. Although very compact, it incorporates motorized film advance, and automatic TTL metering, both as standard features. It has an electronically controlled leaf shutter and, like the Pentax, it is much more convenient to use than other rollfilm cameras.

The motorized film advance fitted to the Rollei is not unique—several other models can be fitted with motordrives as accessories, and the Hasselblad EL/M has one permanently attached. In all other respects, though, this camera is identical to the Hasselblad 500 C/M and both models can be fitted with the same range of lenses and accessories.

Separate magazine loading

The backs of Hasselblads and other cameras can be removed. This means they can be preloaded with film, and changing rolls just means swapping backs

1 Remove insert *Lift and turn the catch on the magazine's side. This releases the rollfilm holder, which is withdrawn to load the film*

2 Lift flanges *Raise the flanges that retain the spools, move the empty spool to the take-up side, and replace it with a fresh film*

3 Extend leader *The backing paper runs under a bar at the edge of the pressure plate. This is lifted by the catch used in the first step*

4 Line up arrows *Wind the knurled knob until the arrows on the film and holder line up. Then replace the holder in the magazine*

5 Check for dirt *Check the film aperture to ensure that no dirt or hairs are trapped between the film and the magazine shield*

6 Wind to first frame *Crank the wind-on until a number 1 appears in the frame counter window. The magazine is then ready for use*

Roger Fayling

Agfacontour

This unique material reacts to light quite differently from any other film—the results can be intriguing or surreal, and you need no special techniques to produce them

Agfacontour is a special high contrast black and white film, designed for graphic arts or scientific use. Because of its peculiar response to light, it gives unique graphic effects—but it requires no special techniques or equipment, and you can create a whole range of special images in your darkroom.

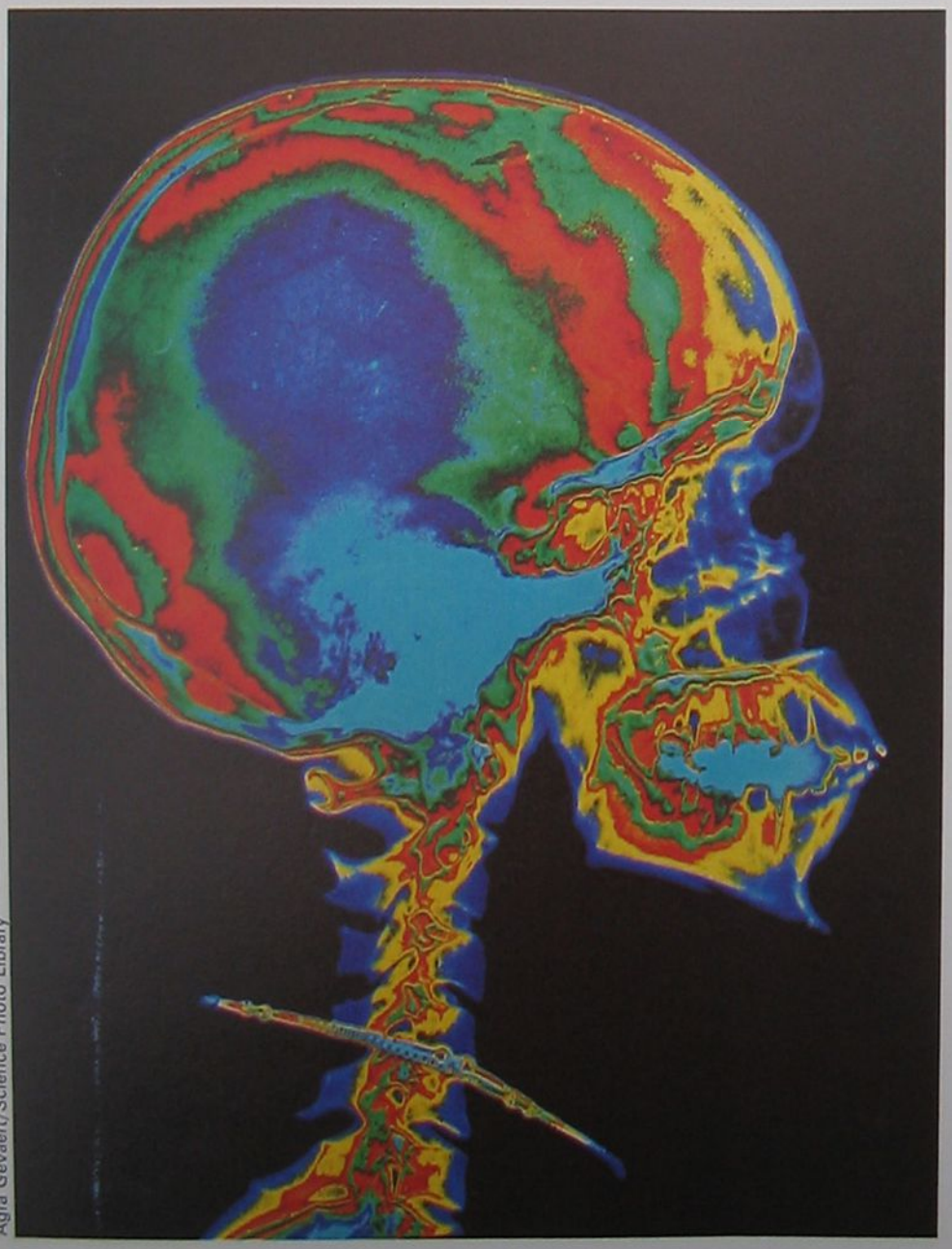
Originally, it was developed for such specialized uses as photogrammetry, mapping and astronomy, but the results it gives are similar to many darkroom special effects and you can use the film to produce these effects much more simply.

Agfacontour gives extremely high contrast, like lith film, and strong line effects—but unlike lith film it can produce an image so different that the original subject is barely recognizable. This is because it does not record an image in terms of shadows and highlights, but in terms of *equidensities* or lines of equal tone density.

The film is coated in a mixture of silver bromide and silver chloride emulsions, which deposit silver both by chemical and physical development. When you expose and process a sheet of Agfacontour, the areas which are most exposed are developed chemically, and those which receive least exposure develop physically. The result is an image which is black in both areas. Only in between these is there a thin, clear line—the equidensity.

The image you obtain, therefore, is like a map of the densities of the original subject—hence the film's name. The equidensities link areas of equal tone density—just as contour lines link points of equal height on a map. The effect of a single exposure looks rather like pseudo-solarization, but because only one, very narrow, range of density creates the equidensity, the subject may not be recognizable. By printing your original several times on different sheets of Agfacontour, and varying the exposure each time, you can build up a set of different equidensities. When these are printed in succession on a sheet of bromide paper, they look like fine line drawings.

Agfacontour is not really suitable for exposure in the camera, because it is very slow—about the same speed as bromide paper. Nor is it red-sensitive, but this is an advantage in the darkroom, because the film can be handled under a red safelight. In fact, the emulsion is only sensitive to green light in the highlight part of the exposure, and blue light in the shadows.



Agfa Gevaert/Science Photo Library

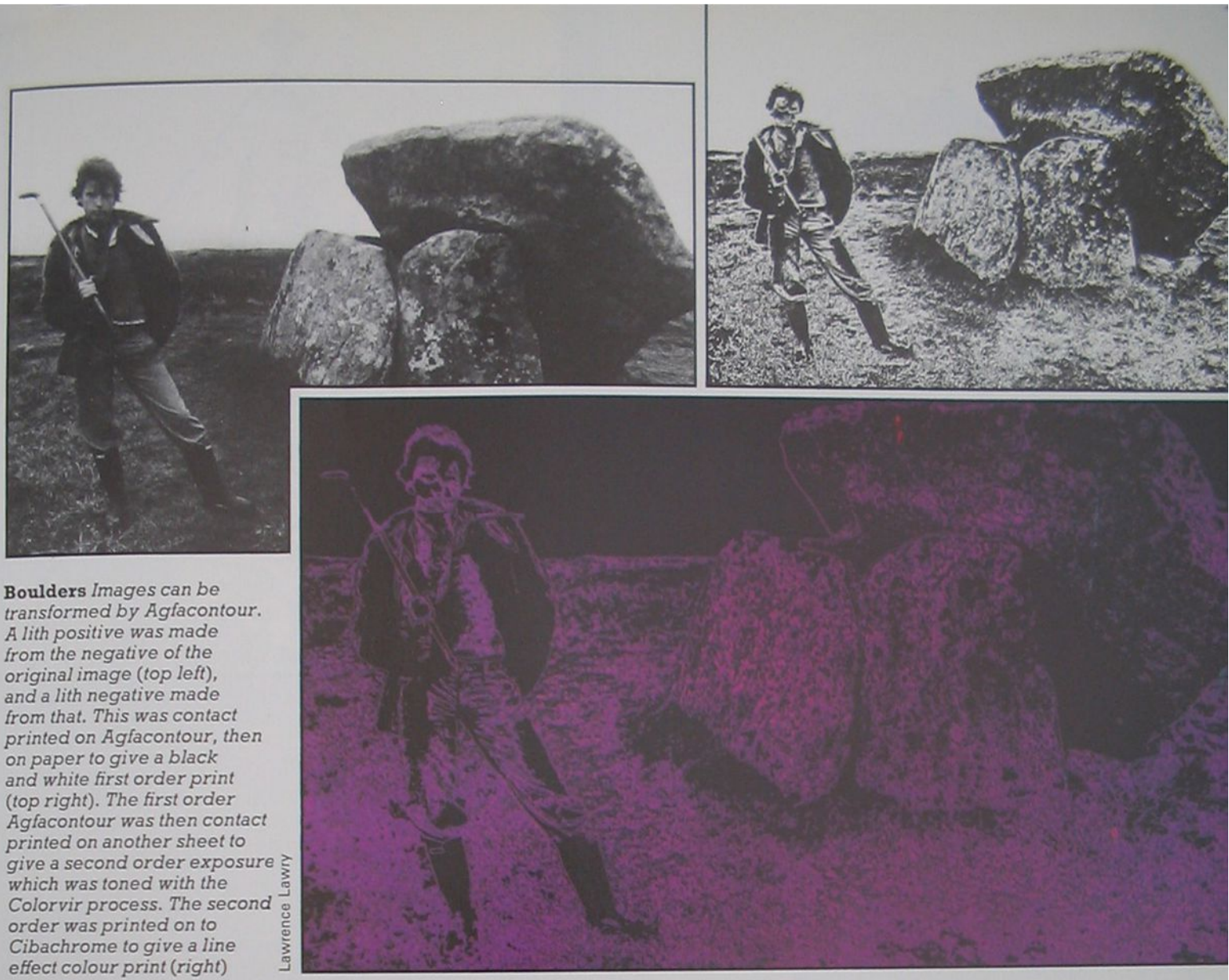
Skull *Agfacontour was used here to change the grey shades of an X-ray image into a brightly coloured print*

Controlling equidensities

You can control the equidensities both by changing the exposure and by modifying the colour of the exposing light. The amount of exposure you give determines where, in the scale of tones between shadow and highlight, the equidensity occurs. The colour of the light, however, controls the width of the equidensity.

The best way to understand how the first of these factors works in practice is to contact print a step wedge—the two ends of the scale appear black, with a clear equidensity step in between. This illustrates how only one tone in the scale reproduces as a clear line. By giving more or less exposure, you can govern at what point along the scale this clear area occurs. These different exposures each show a clear line at a different point on the scale—in other words, only a certain amount of light gives clear film; more or less light both produce black.

By varying the colour of the enlarger light source, you can also control the width of the lines. Yellow filtration gives



Boulders *Images can be transformed by Agfacontour. A lith positive was made from the negative of the original image (top left), and a lith negative made from that. This was contact printed on Agfacontour, then on paper to give a black and white first order print (top right). The first order Agfacontour was then contact printed on another sheet to give a second order exposure which was toned with the Colorvir process. The second order was printed on to Cibachrome to give a line effect colour print (right)*

Lawrence Lawry

very fine lines, while magenta gives wider lines. Using a 50 yellow CC filter, for instance, the film has a resolving power of about 50 pairs of lines per millimetre. You can demonstrate this too on the step wedge—the simplicity of the image shows the differences in line width clearly.

Combining equidensities

This process allows you to produce recognizable images on Agfacontour from your original. This can be either colour or black and white, negative or transparency—however, to exploit the film's properties to the full, it is advisable to make a high contrast line copy first, on lith film for instance, and to work from that.

From a correctly exposed sheet of Agfacontour, you obtain a single equidensity. This is known as the *first order*, and can be copied on to another sheet of Agfacontour. The resulting image will have two very fine clear lines, where the first had only one. This is known as the *second order*—repeat the operation and you produce a *third order*, with four, even finer lines. By combining differently exposed sheets of Agfacontour in the same print, you can produce an interesting version of any original.

Printing procedure

To expose Agfacontour, a normal enlarger with a filter drawer is adequate, but a colour head is better, if you have one. Your darkroom safelight should be at least two metres from the printing area.

Contact print your original as you would for a black and white contact print, emulsion to emulsion under a sheet of glass. This must be absolutely clean, as every speck of dust shows up as a fine clear outline. Stop the enlarger lens down to *f*/8, and expose a test strip on half a sheet of film, for economy. Steps of 10, 20, 40 and 80 seconds are suitable.

The sheet must be processed in special Agfacontour developer, which has to be made up beforehand, and left long enough to cool. This has a working life of about three weeks. One litre of developer will process up to 0.25 square metres of film. Partly used developer must not be returned to the stock bottle. Time and temperature are extremely important in this process—the sheet should be developed in pure developer for two minutes at 20°C, with continuous agitation.

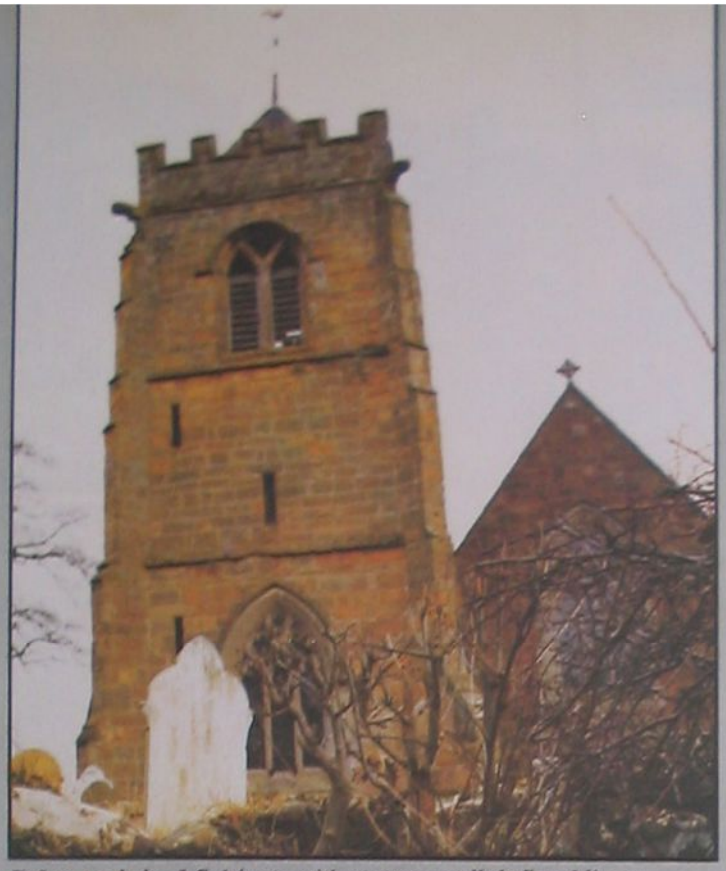
After development, the sheet must be put in an acetic acid stop bath (three per cent) for 30 seconds, or dichroic fog is almost certain to form. It can then be fixed in your standard fixer for the requisite time, and washed for 15 minutes in running water. It is essential that your development time is consistent, or the equidensities will not occur where desired.

Assessing results

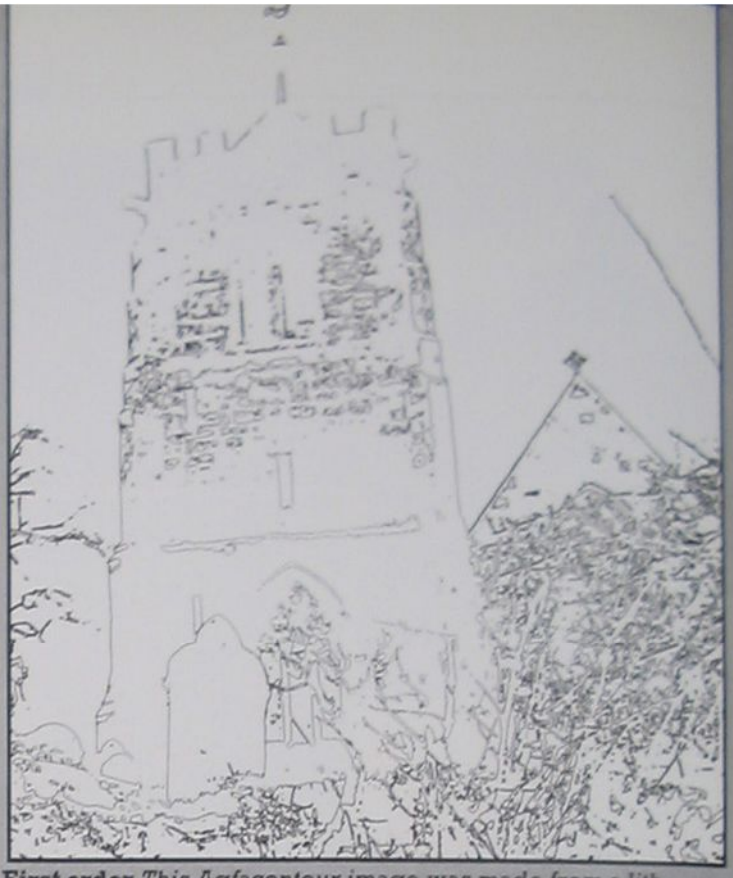
If the exposure is too great or not sufficient for an equidensity to form, the processed sheet will be completely black. You can, however, easily tell whether this is due to over- or underexposure. An underexposed film is bluish black, whereas when overexposed it is mainly brownish black.

If the exposure has been such that part of the film has received the right amount of light, the film will show an equidensity at some point. You should look for the step on the test where the image is neither predominantly positive nor negative, and make a note of the exposure time. Check also the width of the line, to make sure it is what you want. If it is too wide or too narrow, you may have to adjust filtration to change this.

Expose and process a sheet of Agfacontour at the established exposure time—make certain that it receives



Colour original *Subjects with strong, well defined lines are especially suitable for making Agfacontour images*



First order *This Agfacontour image was made from a lith positive of the colour original—note the fine line detail*

exactly the same processing. If your original image is a high contrast one, such as lith, the Agfacontour will appear as a set of single fine lines. If you have been working from a continuous tone image, the first order on Agfacontour will not consist of lines until the second order has been made.

Making 2nd and 3rd orders

This is theoretically very simple—you simply contact print the first sheet on to a second one, using the only exposure which makes the film work, and each line is reproduced as two lines. You cannot select your equidensity point for the second and third orders, unlike the first, where you can make your density split at any point desired. You can then make a similar test from the second order to make the third order, in which the two lines will reproduce as four.

In practice, though, it is not always easy to 'punch through' the first order when contact printing it, and even more difficult when making the third order.

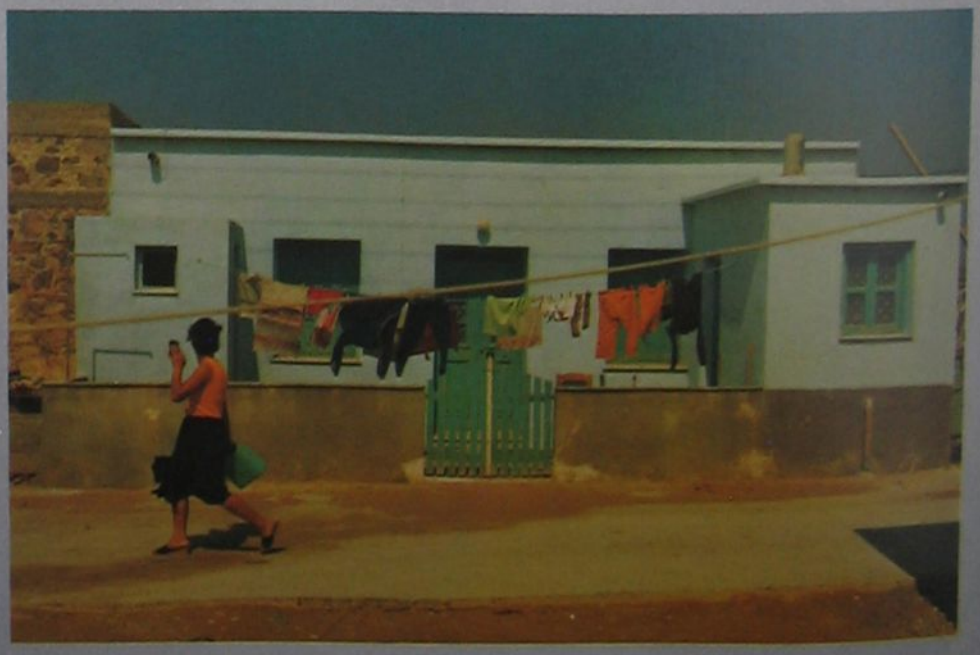
When this happens, make a contact print of the first order on a sheet of lith film, making a bright, clear positive. You can then contact print this on a sheet of Agfacontour to make the second order, and repeat the procedure for the third order.

Printing on paper

The first order will probably not be very suitable for printing on paper—but second and third orders can both be contact printed to make unusual paper prints. To make a 'line drawing', contact the Agfacontour sheet directly on to a sheet of bromide paper—the print will be white with black lines. For a black print with white lines, contact your Agfacontour sheet on lith film first, and make a paper print from that. Either of these prints can be toned, as described on pages 710 to 713.

Another effect is to make a group of equidensities, from either a monochrome or a colour original—the result can be reproduced either in monochrome or in colour. Having made a test strip on Agfacontour from your original, select four different equidensity exposures—they will probably be fairly close together. Do not make a second order for this technique—the first order is adequate. Give each of these exposures to a different Agfacontour sheet, and contact print each sheet on to lith film, giving a set of lith positives. These can be toned, using the Tetenal method of colour toning shown on page 1734.

When the lith positives are dry, they can be arranged in register on a lightbox. For best results, contact print or enlarge the combination on reversal printing paper such as Cibachrome—the result is an attractive coloured line print. By toning and printing the lith positives individually, you can also achieve an effect similar to colour separations—while if you print them slightly out of register you can produce some very unusual and interesting bas-relief effects.

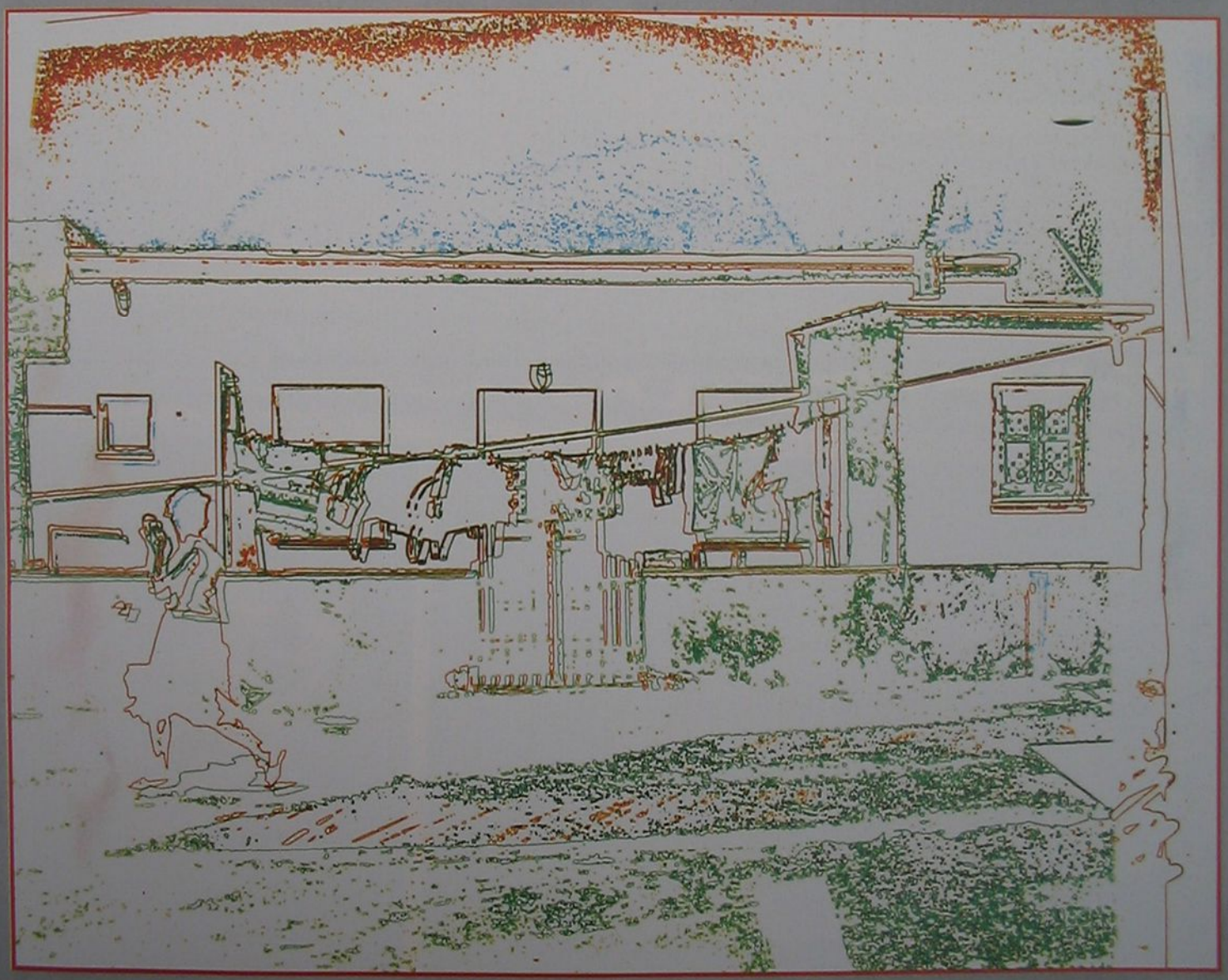


Bas-relief *Differently exposed sheets of Agfacontour, derived from the colour negative, were printed slightly out of register, using different filtrations*

Line detail *Enlarging a section of the first order print shows how fine details are reproduced as single lines*

Second order *The same section of the second order shows clearly how a single line is replaced by two finer lines*

Tim Stephens



Tim Stephens

BARBARA BORDNICK

Bordnick/Hatton

Barbara Bordnick has succeeded in the tough New York fashion world, yet her pictures have a lyrical quality, quite different from her everyday life

If there is one thing that lifts a fashion shot out of the ordinary, it is style, and style is something that the pictures of New York fashion and beauty photographer Barbara Bordnick have in abundance. Whether it is a soft romantic look for a beauty product or cool elegance for a new range of clothes, Bordnick's flair for detail and her eye for colour and lighting help to create the mood completely. Yet recently, she has been making a name for herself with a series of strikingly clear 10 × 8 portraits on Polaroid.

Barbara Bordnick first became fascinated by photography when she was a fashion student at the Pratt Institute in New York. 'I remember the very day when a girlfriend and I were looking through an issue of *Harper's Bazaar*. I said, "Isn't that beautiful", and she said, "Oh, isn't that wonderful". And after about a minute and half of talking, it became apparent that I was talking about the photograph and she was talking about the fashion. That's when I really started looking at photographs properly.'

Later, after a visit to Europe, Bordnick decided to drop fashion design altogether and take up photography as a career—though her fashion training has proved its worth many times since. Without a formal photographic background, she found it extremely difficult at first to break into the professional world and tried desperately to use every contact she had. Eventually, after months of disappointment, she persuaded a friend of a friend to let her work as his assistant for nothing. Unfortunately, after only four months, even this job came to an end, and she had to start all over again.

After more frustration and fruitless search, she decided that the only way to get anywhere was to set up on her own. One thing she had learned in the four months as an assistant was confidence. She had watched the photographer working very decisively and deliberately, and the decisiveness rubbed off on her. Things that had seemed difficult, such as lighting and colour balance, suddenly became much easier and she became sure that she could succeed on her own. She borrowed $1000 from relatives, bought a strobe and converted a small room in her house into a studio. With just one Nikon camera and one 35 mm lens, she was in business.

As she said later, 'I just didn't know enough to know I was crazy to start like this.' Fortunately, the time was right. In the 60s, women photographers were a rarity at a time when women were in the news. A talented woman photographer, therefore, could get on very rapidly, and, after only six months, Bordnick was working for *Harper's Bazaar* which, at the time, was the best fashion magazine in the world. In fact, she was, at the time, the youngest freelance photographer ever to work for *Harper's Bazaar*, and she was competing with such established fashion photographers as Richard Avedon and Hiro.

It was an ideal beginning for a young photographer. Bordnick attributes much of her success then to her involvement in the styling of her photographs. She enjoys paying minute attention to detail—from the clothes and accessories of the models to the furnishings or props in the background.

'I think styling has become the signature for most women fashion photographers. Women are more involved in styling, because fashion is something we're involved in throughout our lives. After all, we wear it . . .'

Bordnick had an original way of putting different combinations of clothes together. Her first major spreads for *Harper's Bazaar* were notable because she defied convention and photographed leather clothes in a soft, romantic way.

'I had a more nostalgic way of seeing women. I guess that my fantasy was much more of another era. I never really thought of myself as someone of this era. I loved the pictures of my mother in her great 30s and 40s clothes. When I first started working here I was thought of as a very European photographer. American photography was all harsh shadows and bright colours. I didn't shoot like an American or see colours like an American.'

Bordnick enjoys working closely with an art director and always prefers to know how her pictures are to appear on the page before she takes them. At *Harper's*, the art editor would discuss with the photographers the way pictures were being used throughout the magazine to give them some idea of how theirs would fit in.

A close creative relationship between the art director of an advertising agency

Donald Pleasance *A clear example of Bordnick's uncluttered and classical approach to portraiture.*
Gold Bag *This shot was for a spread in the 'New York Times Sunday Magazine'*

Bathing suit and red hat *This picture was part of a promotion for the Minneapolis department store, Daytons*

Pierrot *Bordnick built a special light set for this Saks Fifth Avenue Christmas catalogue.*
Barbara Bordnick *'My photographs are a projection of myself'*

BARBARA BORDNICK

or public relations unit and a photographer may also produce some award-winning ideas although this is more difficult to achieve. One of the best examples of such a collaboration was the work Bordnick did for the Minneapolis department store Dayton's, with their art director, Karen Brown.

Brown approached Bordnick to do a series of double page advertisements for the store. Brown had a clear idea of the kind of image she wanted to present and chose Bordnick for her particular understanding of fashion and for her 'soft' approach to the portrayal of women.

The spreads that resulted are a superb series showing slightly mysterious and very glamorous men and women in a number of different situations. Although the styling is, as always, meticulous, you have the sense that the pictures are not telling you the full story about the situation. You want to know more. The women are characteristically soft and romantic but with more than a hint of their underlying sensuality. The series won Bordnick and Brown a New York Art Directors' Award.

For Bordnick, the assignment was ideal. It not only gave her the chance to be creative, but also gave tremendous scope for her production talents—her ability to organize the people and props for the session and get the set and costumes looking just right. The production side is something many photographers neglect, yet it is she feels, the key to success in advertising and fashion work.

It was her production skills that won for her the coveted CLIO advertising awards in the mid 70s for a series of films for the clothing manufacturers J. C. Penney. Although she had little experience of movies, her ability to organize the production more than made up for any ignorance of movie technique and the result was slick and inventive. Nevertheless, it is still photography that she most enjoys.

One of her favourite assignments was one that she initially almost refused. This was when the art director of the Saks Fifth Avenue department store asked her if she would do a still life booklet for one of their Christmas cosmetics' promotions. Normally, she cannot stand still life photography. As she explains, 'When I used to have to do products for a beauty shot, I would only be behind the camera for about five minutes before I finally looked at my assistant and said, "If this thing doesn't walk, talk or get off the set I'm going to scream." Then I would leave it for them to finish and leave. Photographing inanimate objects just made me crazy.'

Naturally she did not at first respond enthusiastically to the Saks' request, but later discussion convinced her that it was going to be more interesting than she thought—particularly as they wanted to include mime artists in the shot.

'I started to get more and more fascinated by the idea. So I told them that, if they would pick up my expenses for figuring out how to light the shots and for building special lighting equipment, I would do it. That art director knew how to get the best work out of me. I built my own lighting set-up and had more fun than I'd had in years.' The result was a superb full-colour 12 page booklet which conveys all the Saks luxury image.

Another very successful assignment was the series of 10 × 8 portraits that she did for the Polaroid Corporation. 'They phoned me and asked me if I wanted to play with a new material which wasn't yet on the market—a new film they had developed. I was very flattered. It was exciting to be asked to be part of the launch of a new product. Then they told me it was 10 × 8 and my heart sank.'

Reluctantly she told them that she never shot on anything larger than 35 mm and that she did not even know how to work a 10 × 8 camera. Polaroid were undeterred. They had anticipated the problems and offered to pay for an assistant who was used to 10 × 8 and to send a team of Polaroid technicians along. One of the small number of photographers chosen to test the film, Bordnick found that she was also the only one who did not usually work with a large format camera. In the end this worked very well for both sides.

Using the Polaroid was a revelation to Bordnick. 'I fell in love with the process and the material. I felt it was a missing link, it seemed to be something that I had wanted to do subconsciously for a long time.'

Bordnick's success and her enthusiasm for the new product prompted Polaroid to give her some more commissions and, eventually, they asked her to submit a proposal for a large-scale project.

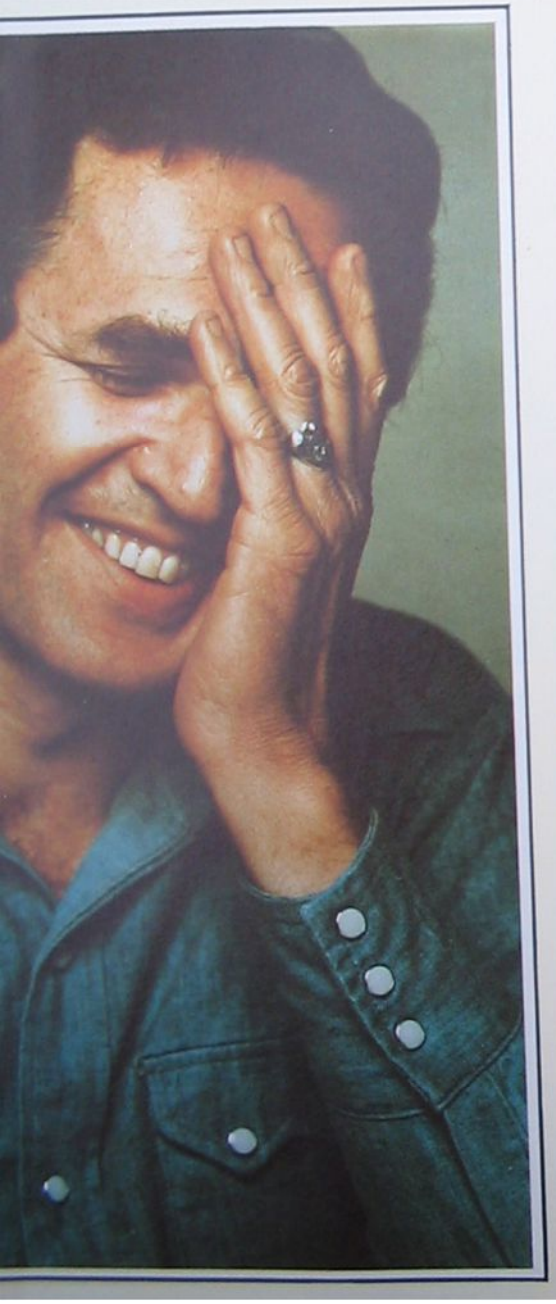
Always keen for a challenge, Bordnick

Flute *For the diamond company De Beers. Its soft and dreamy atmosphere is typical of much of Bordnick's work*

Alberta Hunter *The octogenarian song writer and singer is a legendary figure in the history of the blues. Bordnick took a series of portraits of jazz women for a calendar*

Jay Maisel *This fellow photographer remained in control throughout the session—until this shot*

Delfina Agnelli *The heiress to the Fiat fortune as a model in a 'working situation'. 'New York Sunday Times'*



BARBARA BORDNICK

chose to do a calendar for this project—she considered photographs for calendars to be a dead art in the United States. To add to the challenge, having spent nearly 10 years of her career photographing women and fashion, she decided this time to photograph men.

'I wanted people that I would find interesting and, above all, I didn't want to photograph women. I sat there until 3 o'clock in the morning torturing myself, trying to think of a project on a cohesive group of interesting men. But there weren't any—at least none that hadn't been done. Men get coverage. Women don't. So when someone suggested doing a series on female entertainers I realized that it was the right idea.' A series of extremely fine portraits of *Women in Jazz* was the result.

Bordnick approached this project in the same way that she approached her fashion pictures—with complete professionalism. Each of the artists was approached first by telephone and then with a follow-up letter containing samples of her work. She also emphasized her main intention—that her subjects should look good. Before the portraits were taken Bordnick's stylist, Barbara Turk, saw each woman's wardrobe and discussed preferences if special clothes were going to be obtained for the sitting.

At the actual sitting the women were made up by a make-up artist who could apply a specialist knowledge about the way different film emulsions and lighting render skin tones. The backdrop was generally plain coloured muslin.

Bordnick used a standard lighting set-up for all the portraits. The backdrop was illuminated by two 400 joule strobes placed at 45°. The subject herself was lit by the light from four Calumet 3000 flash generators delivering 6,400 joules to a quad head which were bounced into an umbrella covered with diffusing tissue paper. In order to speed the amount of exposures she could take, Bordnick used four holders on her 8 × 10 Deardorff camera, and two processing units.

Bordnick feels that the atmosphere of the shooting session itself is all-important. Once the subject is dressed and made-up she has already been made to feel good, and the Polaroid process itself gives them confidence.

'Portraiture for me is an extremely intimate experience. When you're photographing a person for a portrait you have a responsibility to capture something universal in that person. Everyone has to be able to relate to the picture and, if it's at all successful, feel that now they know something about the person.

'So before I did the shooting I decided to go and see them in performance. I wanted to see exactly how they projected themselves on stage so that I could find out exactly what their kind of "star quality" was and capture it on film. Most of these women were at quite a sensitive age to be photographed. In your 50s and 60s you are not young enough to have perfect complexion and not old enough to have the wrinkles that give you character. I wanted very much to present them with the dignity I felt that they deserved as artists and in recognition of the fact that jazz is America's only recognized indigenous art form.'

The portraits done for this series have been followed by Polaroid portraits of numerous other personalities including photographer Jay Maisel, *Life's* picture editor John Loengard, and the actress Angela Lansbury. All of them have a remarkable clarity and show Barbara Bordnick to be a superb portraitist as well as an original fashion photographer.

In her fashion pictures there is usually a great deal of extra information. The background, props, and accessories all have to be combined with clothes and models to make the final image. In direct contrast, her portraits are classical and uncluttered. All attention is focused on the subject. Bordnick may decide that a particular character warrants a close-up or a long shot, but in either of these all non-essential information is eliminated.

Working as a photographer in Manhattan is not the easiest way to make a living, and Bordnick is aware that many of the people she meets are surprised by her photographs.

'They think I'm a tough New York lady but they can see my photographs are soft. Sometimes its hard for me to understand it myself. I have a very lyrical point of view in my photography which I don't have in my everyday life.

'Perhaps in a way my photographs are a projection of myself, a fantasy world. I look at people in the way I would like to be looked at or wish I was. I respect the vulnerable quality in people. Somehow my photography seems to be a celebration of that.'

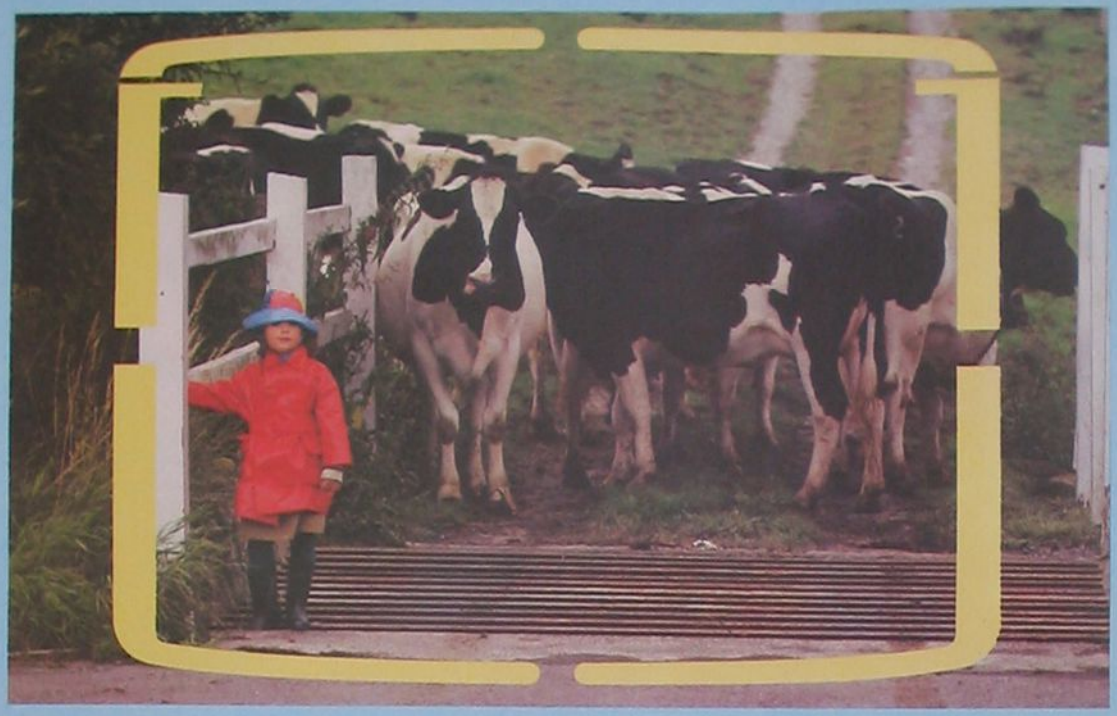
Oscar de la Renta *From the Daytons assignment which won Bordnick and the art director, Karen Brown, The NY Art Directors' Award*

Angela Lansbury *The respected English character actress (near right).*
Donna Mitchell—*one of Bordnick's favourite models (centre).*
Butterfly *Again, for Daytons. Bordnick uses a special filter she makes herself to accentuate the dreamy quality of her work. She believes that the best of fashion shots are portraits of a sort*

Understanding...

Viewfinder optics

For accurate composition it is essential to have a device which shows you what the camera sees—a viewfinder. But some designs must do much more than this



John Freeman

Bright line *An Albada finder produces a bright line frame and is a cheap and effective way of showing the field of view of the lens*

Viewfinder lenses *Although the basic finder has only two elements, extra ones are used to control the field of view and give a clear image*

A good viewfinder is a valuable asset on any camera. Indeed, some cameras are highly rated because of the excellence of their viewfinder arrangements and, in many cases, the whole camera is designed around the viewing system—such is its importance for good photography.

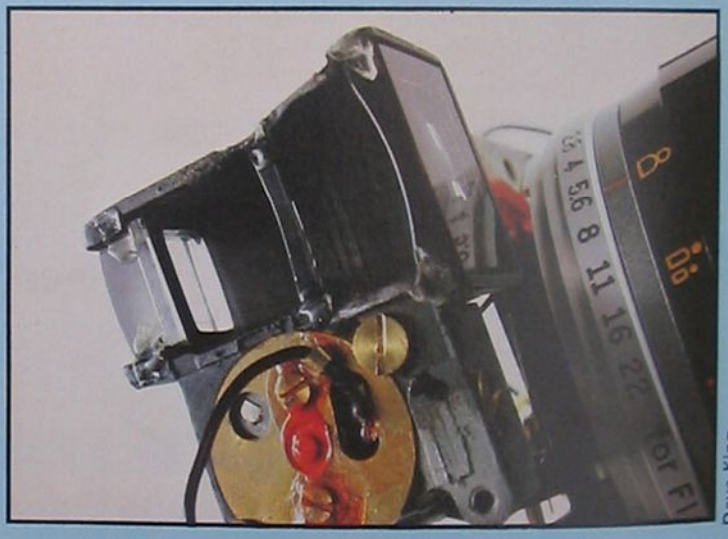
Viewfinder systems range from the very simple to some as complex as photographic lenses. Each system has its own advantages and disadvantages, but they all serve the same basic purpose—to show you what is included in the picture area so that you can aim the camera lens and compose properly. In more advanced cameras the viewfinder also provides some means of checking the focusing of the lens, and includes devices for displaying data such as aperture and shutter speed.

The most basic viewfinders are generally completely separate from the lens–shutter system of the camera and simply show a similar view to the lens. These are known as *indirect* finders. More complex systems, on the other hand, often give *direct* viewing, allowing the photographer to look directly through the lens and see the scene precisely as it is projected on the film. The most important example of direct viewing is of course the single lens reflex camera.

In the early days of photography some cameras simply had two angled lines engraved on the top to indicate roughly the field of view given by the lens. This was soon replaced by a slightly more sophisticated indirect system called the *folding frame finder*. This consists of a rectangular wire frame in front of a peep sight. This system is actually quite accurate as far as framing is concerned and it is used to this day for low light photography because it is fast and easy to use.

But probably the most common type of viewfinder is the *direct vision finder* which, in spite of its name, is an indirect type. This type of viewfinder is most often found on simple, fixed lens cameras, although more advanced types are used by sophisticated cameras such as the Leica. The most basic version uses just a small negative lens to form a virtual image of the subject (see page 1267). The view is *diminished*—that is, it is smaller than the image given by the naked eye. The result is a wide angle effect corresponding to the wide angle lenses used on simple cameras. As a rule the image size given by this type of viewfinder is between 0.7 and 0.9 times the size given by the naked eye.

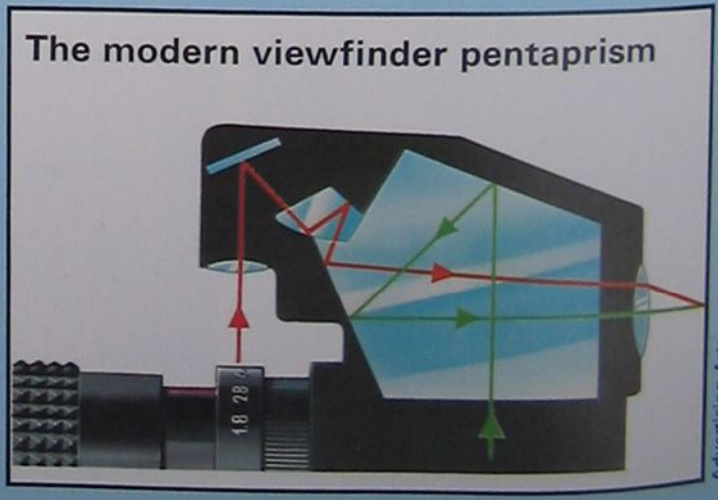
In order to make the view as clear as possible, most of these finders use an additional, weak positive lens to view the image formed by the main negative lens. This



Dave King

Aperture readout *With some modern pentaprisms an extra optical system is included to read the aperture in use directly off the lens*

The modern viewfinder pentaprism



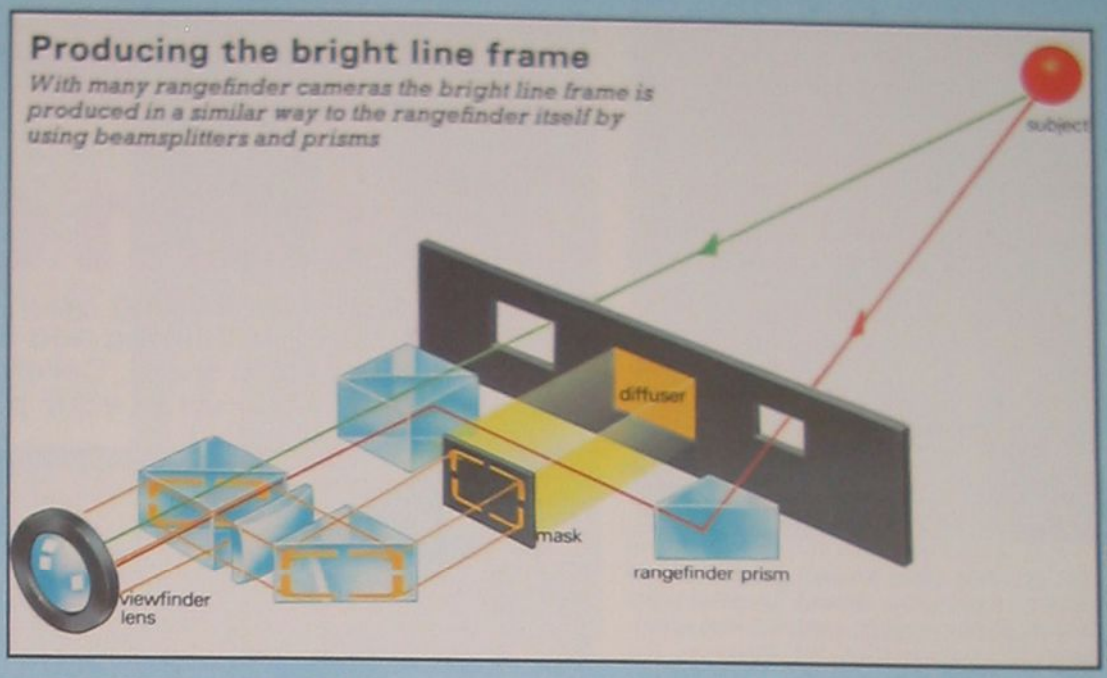
Advertising Arts

type of arrangement is called a *Newton* finder—in effect, a reversed Galilean afocal telescope (see page 659). The effective distance of the image from the eye is usually about four metres, which is a comfortable distance.

To indicate the exact field of view of the lens, a frame is included in the optical system. If lenses of different focal lengths are used the viewfinder can compensate by having supplementary lenses which are introduced into the viewfinder system to change the angle of view. In this way the same viewfinder can be used with two or three different lenses.

One disadvantage with this system is that the frame is often not very clear, particularly at the edges, when the eye is focused on the distant scene. To overcome this problem the *Van Albada* (or simply *Albada*) system was introduced. This produces a *bright line* frame which, because of the optical arrangement is effectively at infinity and so easy to view.

Initially, the bright line was achieved by partially silvering the rear side of the negative lens which then reflected a frame line inscribed around the eyepiece (positive) lens. This arrangement is still used in many cameras. A more sophisticated version is used on interchangeable lens rangefinder cameras such as the Leica. This version has several sets of frame lines corresponding to a range of lenses and these are illuminated by a diffuser window set into the front of the camera. The lines are superimposed on the viewfinder image by means of a beamsplitter in a similar way to a rangefinder (see page 610). A great advantage of this system is that the frame lines can be linked to the focusing mechanism of the lens so that they move when the lens is focused at close distances. In this way the viewfinder automatically compensates for parallax.


Producing the bright line frame
With many rangefinder cameras the bright line frame is produced in a similar way to the rangefinder itself by using beamsplitters and prisms
subject
diffuser
mask
rangefinder prism
viewfinder lens
Advertising Arts

Franz Berko/Paul Popper Ltd.

Eye to eye *Old press cameras had wire frame finders which were fast to use because of the clear, uninterrupted view*

Direct viewfinders

Parallax is not a problem with direct viewfinder systems. The simplest types, like those on large format cameras, use just a piece of ground glass in the focal plane of the camera. The exact subject area is shown and focusing is very precise. However, it is necessary to replace the ground glass with a film holder for the actual exposure, and the screen image is inverted. Many people find this type of viewfinder inconvenient.

Nevertheless, the problem of the inverted image can be overcome quite easily. The light beam from the lens is interrupted by a mirror at 45° to the optical axis which bends the light rays through 90° on to a focusing screen. This is the system used on all SLR cameras. The mirror is raised out of the way just prior to exposure. Twin lens reflexes (see pages 390 to 393), in spite of their similarity to SLRs, are actually indirect viewfinder cameras as the lens which produces the image on the screen is separate to the taking lens.

This system means that the viewing lens can have a much simpler construction, so allowing a larger aperture. The result is that the image—reflected on to the screen via a fixed mirror—is very bright. The viewing lens has the same focal length as the taking lens so that the images produced are identical, and the two are linked together for focusing. The drawback with this system is that it introduces the problem of parallax.

The mirror used in both twin and single lens reflex cameras is silvered on the top surface. If it was silvered in the normal way (on the lower surface) it would give a secondary ghost image. This is because light would reflect both from the top, glass surface and the mirrored surface. The mirror is made as long as possible to avoid darkening at the top of the image when using long focus lenses.

Another use of a mirror is in special viewing hoods for large format cameras. The hood is mounted behind the focusing screen to give an upright image.

The screen image now has the advantage of being the right way up due to this reflection, but is still laterally reversed. This reversal is not usually a problem except for action photography. And in any case it is easily corrected by using a *roof prism* (more often called a pentaprism because of its shape). The image through the prism is viewed by a small magnifying glass which is most cases places the image at a distance of around one metre.

Building a 35 mm outfit

Building up and extending your camera outfit is not just a matter of collecting odd pieces of equipment when you can afford them. Careful thought is required to decide exactly what your priorities should be

With such a bewildering array of 35 mm SLR lenses and accessories on the market it can be hard to decide what to buy next and, for many people, building up an outfit is a rather haphazard process. Often they find themselves with an expensive accessory that they hardly ever use while lacking an essential item. To avoid these problems and build up a well-balanced system suitable for all situations, you must plan your purchases carefully.

SLR systems are designed to cater for many different needs and a 'complete' outfit need not include every available accessory. A complete outfit is simply one that suits your needs exactly and no more—it is clearly wasteful to have a complete set of macro lenses if you never do any close-up work.

It is important, therefore, to try and get a clear idea of just what kind of photography you intend to do in the future. If you want to specialize in architectural photography, for instance, the balance of your system should be tipped towards this, and an early purchase should be a 28 or 35 mm shift lens (see page 778). If your main interest is close-up photography, it is probably worth buying a 50 mm macro as your first lens instead of the standard. Although expensive, the macro can give very sharp, punchy results with close-ups and can also be used for normal photography.

If, on the other hand, your interest in photography is more general, or if you have no clear idea of where you want to go, you should try to build up a versatile, balanced system that can give good results in a wide variety of situations.

Camera and lens

Planning should begin at the outset, when you buy your first camera body. Rather than simply buying the best camera you can afford, think carefully about how you expect your interest in photography to develop. If you never buy any more equipment, then the best you can afford may indeed be the wisest choice. But if you plan to improve your outfit gradually it is important to buy a camera that you can uprate without making all your lenses and accessories redundant. In particular, the lens mount should be compatible with the camera you want.

Essentially, this means buying a camera from one of the SLR systems manufacturers. Although cameras from these manufacturers are generally more expensive, most have an economy model—the Nikon EM or the Olympus OM10, for example—which is often very good value for money. Many lenses and accessories within these systems will suit both the cheapest and most expensive cameras in the range. So when you eventually want to buy a more expensive camera you can simply buy a new body and continue to use the rest of your outfit (see page 1158).

People tend to automatically buy the standard 50/55 mm lens with their first SLR. But with many cameras, you can buy just the body and then choose the lens separately—the best lens need not be the standard lens. Although often of very high quality, the standard lens is very much a compromise between the coverage of a wide angle and the selectivity of a telephoto. If you never buy another lens, it is perhaps a good compromise, but as soon as you start to acquire additional lenses, you will probably find that you use the standard lens less and less.

A suitable first lens, therefore, might be a medium wide angle such as a 35 mm. This is generally the cheapest wide angle lens in the manufacturer's range and is not so wide as to cause constant problems with perspective. If you anticipate buying a medium telephoto in

Dave King

Complete outfit *As well as cameras and lenses this outfit contains many other useful items such as tape, filters, spare batteries, reflecting material, lens brush, tissues, tape recorder, wax pencils and cable release*

Standard filters *These filters are all you need for most situations. They are 81A, 82A, red, yellow and polarizing. Having lenses with the same filter mounts greatly reduces costs. The lenses here range from 24 to 200 mm and all have 49 mm threads*

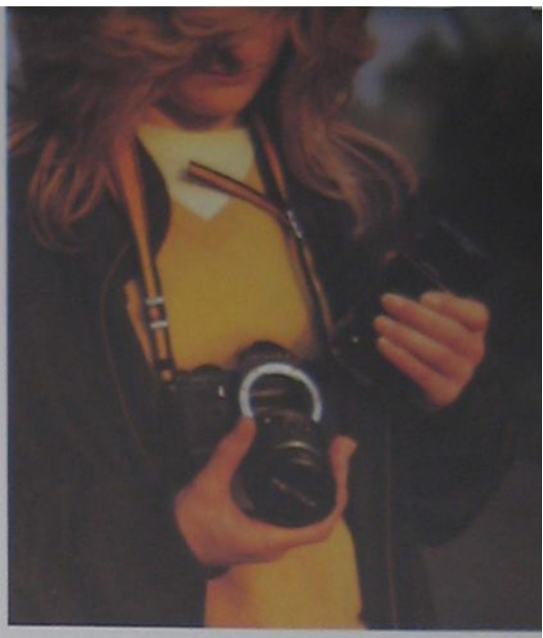
the near future, though, it would be worth getting a 28 mm or even 24 mm.

Nevertheless, there are two significant drawbacks to the wide angle as a first lens. First, if you have no darkroom or shoot mostly on slide film, it is far harder to take advantage of the facility for composing the picture after processing. Indeed it may be positively annoying—and expensive—if all but a few of your pictures are not perfectly framed at the time of shooting. For experienced photographers, this does not present a serious problem: they can adapt their style to the lens and compose well even with a wide angle lens. But for those only just beginning to develop their eye, it can be far harder composing with a wide angle. Indeed for the newcomer to photography, it is probably better to go the other way altogether and settle on a medium telephoto such as an 85 mm as a first lens. With the telephoto, it is far easier to be selective and fill the frame without moving unnervingly close to the subject.

The second drawback of the wide angle lens is the problem of unflattering perspective for portraits. While this can be overcome simply by moving back and cropping the picture later, it is again better to buy the 'portrait' lens, a medium telephoto, if you intend to take a lot of portraits.

Another alternative is to buy a zoom. A typical wide-to-tele zoom has a range from 35 to 70 mm and may seem to provide a focal length for most situations, giving sufficient coverage for landscapes and, at the other extreme, good perspective for portraits—apparently the ideal compromise. Unfortunately, zoom lenses tend to be bulky, slow—maximum aperture for a zoom may be about *f*/3.5 compared with *f*/1.4 for a typical standard—and, most importantly, can cost twice as much as fixed focal length lenses. Furthermore, most photographers find that they tend to use a zoom only at the two extremes of the zoom range, and rarely use intermediate focal lengths. If you have enough money for a zoom, therefore, it might be better to spend it on a pair of fixed focal length lenses instead, since these will give better quality results.

Dave King



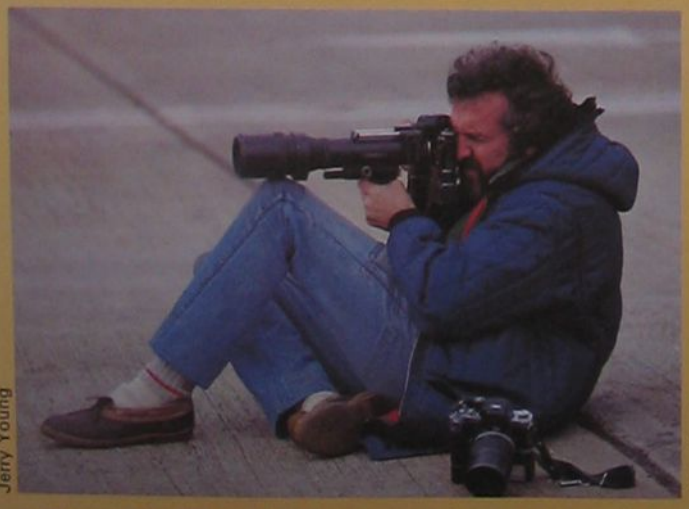
Outfit alternatives *A large outfit is cumbersome and for portability the minimum of equipment is best*

However, there is a great deal to be said for having just one lens to carry around and, as a single lens, a zoom is very versatile. The zoom can be kept permanently on the camera body and, if you have no other major accessories, your outfit is therefore just a single unit. A single unit is much easier to carry around all the time—you do not even need a gadget bag. And again, for the beginner, using a zoom is one of the best ways of learning to compose in the viewfinder.

So, if you are still developing your eye for a picture and do not intend to acquire a second lens for some time, a zoom might be a good choice after all. But instead of a wide-to-tele zoom, which will become partially redundant as soon as you buy another lens, think about a medium telephoto zoom, say 75–150 mm. This is ideal for portraits and a range of other subjects. When you do want a second lens, it will be nicely complemented by a wide angle. Remember, though, to look for one of the new generation of lightweight zooms, or the advantage of mobility will be lost—go for speed and lightness rather than a big zoom range.

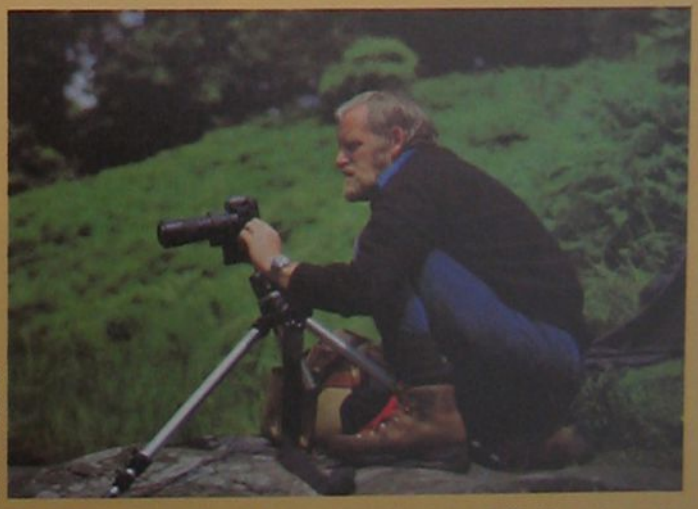
First accessories

Once you have made your decision and bought your first camera and lens, you may not make another major purchase for some time. But there are a number of small items you can buy that will improve your outfit in the meantime—indeed it



Jerry Young

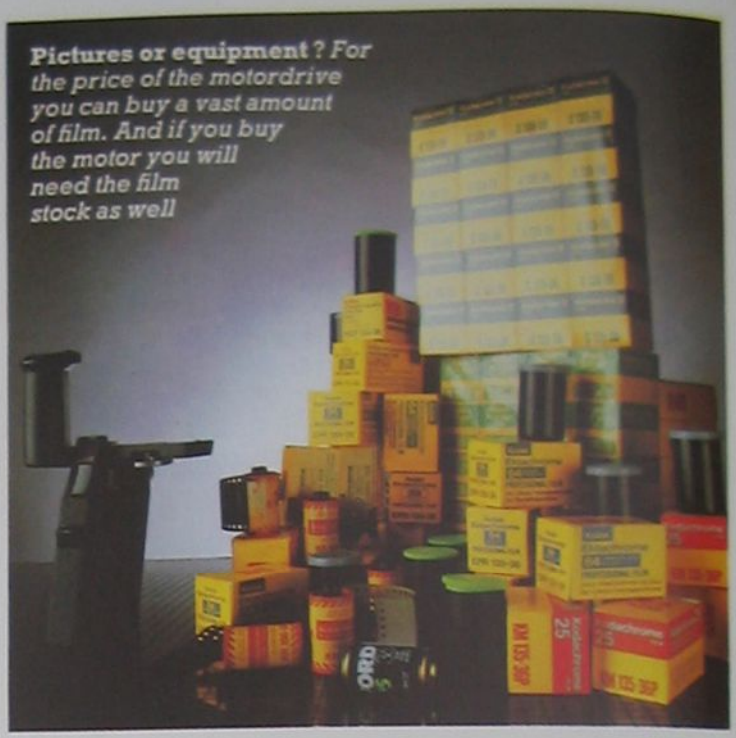
Professional's choice As a general editorial and nature photographer, Peter Kaplan carries a large range of lenses in his outfit. These include a 15 mm super-wide angle, 16 mm full frame fisheye, 24, 35, 85, 180, 200 macro, 300 (f/2.8) and 400 mm Novoflex. The lenses are colour coded so that he can tell at a glance which is which



John Heseltine

The all rounder Colin Molyneux uses a car full of equipment when on assignment. But as a basic outfit he takes at least two camera bodies with motors, 20, 55 macro, 80-200 zoom and 300 mm lenses, a perspective control lens, a tripod and an exposure meter. As most of his work is in colour he usually carries polarizing and graduated filters

Dave King



Pictures or equipment ? *For the price of the motordrive you can buy a vast amount of film. And if you buy the motor you will need the film stock as well*

Motordrive courtesy of Olympus

The basic outfit *A body and three lenses, 24, 35 and 100 mm, are perfectly adequate for most situations*

may even be worth delaying your next big purchase until you have these items. If your eyesight is poor, a correction lens viewfinder (costing little more than a few rolls of film) is a must.

Towards the top of the list are filters. You do not need a full range of filters—special effects filters in particular are largely unnecessary (see page 846)—but two or three can be invaluable.

Get a skylight filter when you buy your first lens and keep it in place on the lens permanently. Its most important function is to protect the lens from dirt and damage and it does this very well, and there are a few occasions in which it positively improves pictures by filtering out UV light.

If you use mainly black and white film, a medium yellow or orange filter is also useful for darkening blue skies so that clouds show up better. If you shoot most on colour slide film you will find an 81A/B or similar filter (see page 278) can extend the range of photography more than you might appreciate. Without this filter, the excessive blueness of photographs taken in cloudy overcast weather may put you off shooting in these conditions. The warming filter reduces this blueness considerably. It may also help to add a pleasant light tan effect to skin in sunny conditions.

If you add to these filters a polarizing filter and a lens hood (see page 574), you should be equipped to shoot in a wide range of conditions yet still remain mobile. There is no need to buy a large gadget bag at this stage: it simply encourages you to fill it up with unnecessary bits and pieces. A few filters and rolls of film slot into pockets far more conveniently. If your camera and lens need protection, either get the proper carrying case or a suitable small lightweight bag.

An inexpensive, but good quality table-top tripod (plus cable shutter release) might also be worth buying at this stage if your first lens is a telephoto zoom or even just a telephoto. If you have a fairly fast lens, a tripod is not really necessary; concentrate on improving your technique to obviate the need. Using a lens as slow as the zoom, however, you will often find you need to shoot at very slow shutter speeds in poor light—and with a telephoto the problems of camera shake at slow shutter speeds are that much more pronounced. A tripod will also allow you to use the minimum aperture when you need it for good depth of field. Remember, though, that lightweight tripods are by no means completely stable and must be used very carefully.

Prime choice *Fixed focal length lenses on two bodies are fast and easy to use*

Dave King/cameras courtesy of Pentax & Cosina

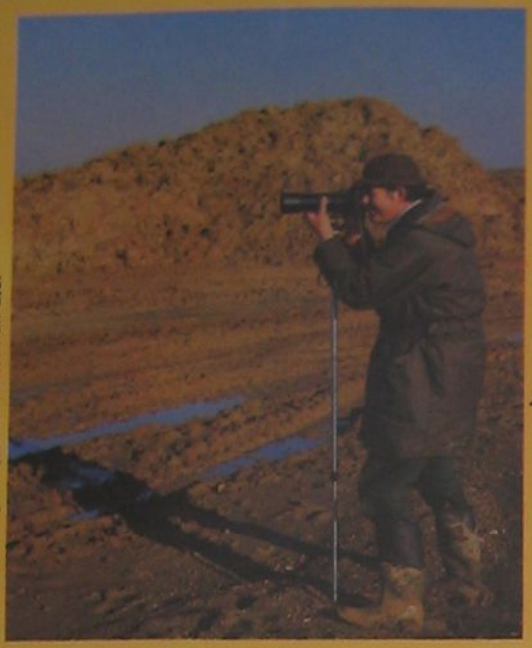
Zoom choice *A body and a zoom gives an outfit which is versatile yet compact*

First major purchase

Many photographers tend to assume that the next major purchases after the camera should be extra lenses. A good flashgun, though, can sometimes be far more useful, greatly extending the versatility and usefulness of a camera, particularly at night or indoors. Try to avoid the temptation to buy a cheap unit—a good, powerful flash gives noticeably better results.

A large powerful unit such as the Braun F910 will enable you to take the kind of pictures you could hardly contemplate before, but it is far from portable. At this stage, a small compact but still fairly powerful gun—Guide Number 32 metres 100 ASA—is useful. This can easily be carried around at all times yet should provide plenty of illumination for fill-in and snap-shots.

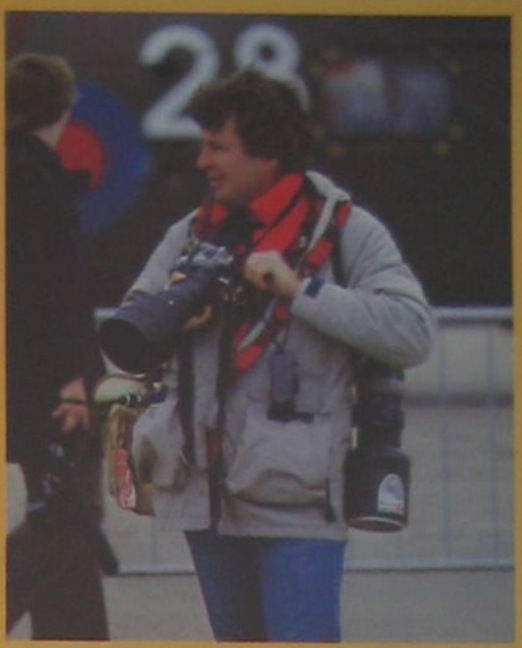
Some photographers buy a full-size tripod after the flashgun but this accessory is rarely as useful as it seems. Carrying even a light tripod around soon becomes very tiring and it is a great temptation to leave it at home when you go out on a photo expedition. Unless you have very specific reasons for using a tripod, then—such as still life work, architectural shots, close-ups or low light photography—you are usually better off with the cheaper and much more convenient alternatives, fast film and push processing.



Gordon Langsbury/Bruce Coleman Ltd.

Ornithologist's choice For his pictures, Gordon Langsbury has a basic outfit with two bodies (one with Kodachrome 64, one with Ektachrome 200), 28, 55 macro and 300 mm prime lenses, an 80-200 mm zoom and a 500 mm mirror lens. He also uses a teleconverter to extend the range even further and has a monopod which is portable and so useful for holding the long lenses steady when stalking birds

Action equipment Motor sports usually require long lenses and so David Winter's most used lens is a 300 mm f/2.8 which, because of its fast maximum aperture is easy to focus and allows fast shutter speeds. He also carries 24, 105 and 600 mm lenses and uses two camera bodies



Jerry Young

Extra lenses

Once you have your range of minor accessories and a flashgun, you can begin to think about a second lens. But the choice is very difficult. Including those made by independent manufacturers, there may be several hundred lenses on the market that fit your camera.

The first decision to make concerns focal length. This depends partly on what lens you already have and partly on any special interests you have. If you have a 28 or 35 mm lens already, it makes sense to buy a medium telephoto—a 28 and a 85 mm make a good pair, as do a 35 and a 105 mm. Similarly, if your standard is a telephoto, a medium wide angle would make a good second lens.

If your first lens is the traditional 50 or 55, though, you have to choose which way to go, wide angle or telephoto. This decision is largely personal preference but, as it is always possible to selectively enlarge a photograph that contains unwanted detail, a wide angle is probably more useful. A 35 mm is too close to 50 mm to be very valuable so go for 28 or 24 mm.

Those who decide a medium telephoto is the answer may be tempted to buy one of the popular 135 mm lens. Surprisingly, perhaps, this is the least satisfactory solution if you are building up a comprehensive outfit. It falls awkwardly between two points—too long for portraits but too short to bring in distant detail. If you subsequently buy either the 105 mm lens for portraits or a 200 mm for sports shots, the 135 becomes redundant.

Again the solution to the dilemma might seem to be a zoom. Yet as a second lens, you have already lost the advantage of mobility—once you start to carry extra lenses around one more makes little difference. Also, by the time you come to buy your second lens your eye for composition should have developed enough for you to be able to work happily with fixed focus lenses. Finally, for the photographer who never enlarges pictures above postcard size, the quality of a medium-priced zoom may be good enough.

Really, then, the basis of a balanced outfit is a medium telephoto and a medium wide angle. This combination should be good for a wide variety of shots and you can supplement them at a later date with a 17 mm and a 200 or 300 mm lens. With this range of lenses you should be equipped to deal with most general photographic situations.

If in doubt about whether to buy lenses from your camera manufacturer's range or from an independent maker, bear in mind the following points. Independently made lenses are generally cheaper than their 'system' counterparts and often perform quite well—particularly those at the popular focal lengths. Nevertheless, it might be better to wait until you can afford a system lens. For the higher price you usually get very high quality optics and if all your lenses are from the same manufacturer you should find them much easier to use. Your outfit may also be more saleable—should you ever want to sell it—with a uniform set of high quality lenses rather than a hotchpotch. If you do decide to buy a lens from an independent maker, remember to check that focusing and aperture rings turn in the same direction as your other lenses. If your lenses focus in different direction you may have problems focusing on moving subjects.

Completing the outfit

In many ways, once you have a balanced collection of four or five lenses, a suitably powerful flashgun, and a few essential small accessories such as filters, your outfit is already fairly complete and there is no need to spend money on any other major items, except for specific purposes. From this stage on, then, you could begin to uprate your system.

Nevertheless, there are a few other items worth mentioning. Close-up equipment can greatly extend your range of subject matter at quite a low cost. Supplementary lenses are undoubtedly the most convenient and economic route to close-ups but they do not give such high quality as extension tubes. Extension tubes, however, are considerably more expensive and are usually sold only as sets. This is a shame since a single 7 mm extension tube in combination with a basic lens is really all you need for most close-ups. Longer tubes tend to languish unused in a drawer. If you do see a 7 mm tube available separately, therefore, it is worth getting.

Surprisingly many amateur photographers spend vast sums of money on a motordrive or winder, but they rarely justify the expense. If you use your left eye for viewing, a motor winder might make the camera more comfortable to use and overcomes the problem of the lever wind poking you in the eye. But a motor drive adds considerable weight to a camera that might otherwise be compact and convenient. More significantly, they can consume film at a prodigious rate—and this is perhaps the crux point in building up any system.

Never spend so much on equipment that you cannot buy film. The equipment is of course useless unless you take pictures with it. It is an old but valid truth that you can take a string of masterpieces on the simplest of cameras. So rather than buy the next expensive lens, consider spending the money on film instead—the practice could widen the scope and quality of your photography far more than the lens ever could. And this is, after all what 'building up a system' is all about.

Creative approach

Graveyards

Graveyards may not immediately spring to mind as photogenic subjects, but they can yield fascinating, atmospheric images

If you are genuinely creative in your choice of subject, from time to time you will almost inevitably be accused of taking pictures of the oddest things. Until they look at the final result, other people may not appreciate the photographic potential that you see. Often, for just this reason, the strangest subjects can prove the most rewarding—as a creative photographer, you can awaken people to just how interesting things really are. If, then, you think that somewhere as lifeless as a graveyard has limited scope for photography, think again—with a little imagination, the local cemetary could surprise you.

Graveyard monuments have always been potent symbols and it is the symbolism that often attracts the photographer and indicates an approach. Celtic crosses in the tiny graveyards of the Irish moors, for instance, are often photographed silhouetted against the sky. This treatment fits in with the rather magical, mystical image of ancient Celtic people—even though the crosses are rarely much more than a century old! But while this approach can sometimes lead to an atmospheric, haunting photograph, it can also restrict the imagination and leave you with a series of clichéd uninspiring images.

It is important, therefore, to try and introduce as much variety into your approach as possible, letting your imagination run riot. One of the attractions of graveyards for photography is that you can do this easily. Many of them are deserted and you work virtually undisturbed. So you can take your time and explore all kinds of angles and approaches. Try to avoid shooting just the obvious features and then giving up. If you have the time, it is well worth walking around the graveyard, carefully noting the possible shots, playing with the alternatives in your mind's eye, before you even begin to shoot. There is almost always a choice of very similar shots and it is easy to waste film by shooting the first example you come across. A leisurely session can lead to a

Paul Joyce

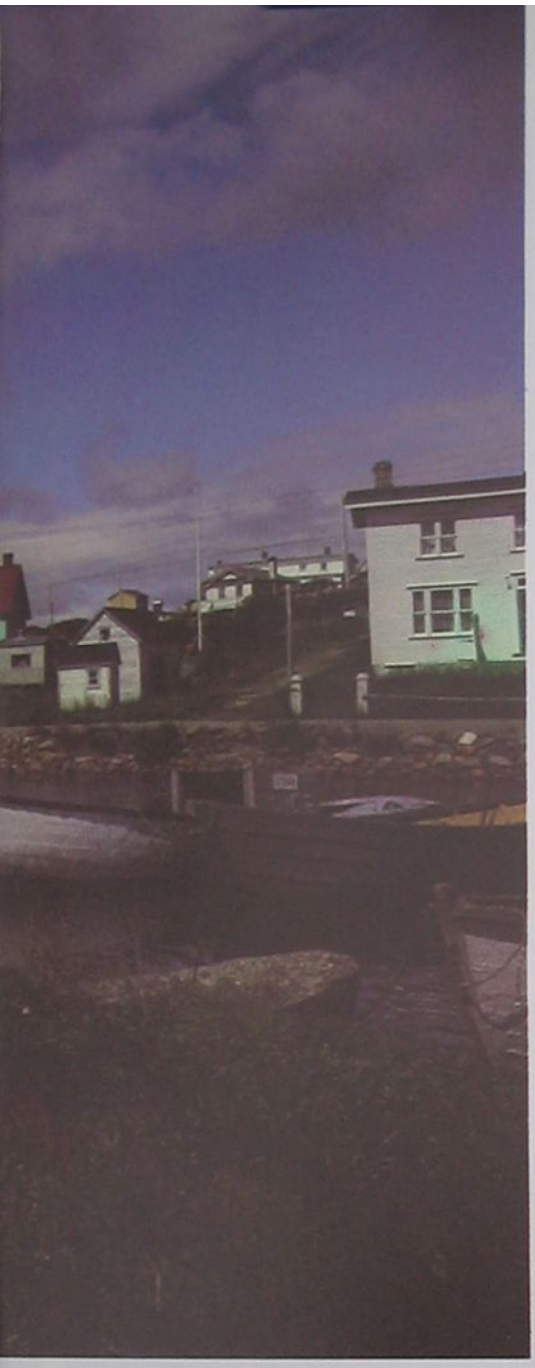
far more critical and ultimately imaginative approach.

In many graveyards, tombstones and tablets are packed closely together and a small change in position can bring an entirely new picture. This means that there is often a tremendous variety of possible shots even in the smallest graveyard, but it can also mean that many pictures are marred by unnoticed or unavoidable background detail. A wrought iron cross which is clearly defined against a distant stone wall could well be lost among the branches of a tree with only a small error in viewpoint. Look out for this kind of mistake and, where necessary, use a wide aperture to throw the background out of focus.

Good quality, slow film and a lens with close focusing ability are useful because there are always plenty of interesting detail shots. A small flashgun may also be useful for lighting dark corners or for sidelighting to reveal engravings clearly. Look for close-ups of some of the elaborate carvings or places where lichen has grown over the stonework. Shots like this are particularly effective when sunlight, from a low angle or dappled by leaves, plays across the surface of the stone, bringing out all the texture and subtle colour variations.

A point to remember when photographing graveyards is that many of them are remarkably colourless. It may be worth introducing a splash of colour to liven up the picture. Something as small as a yellowing leaf or a tiny spray of flowers left by a mourner may be enough. In older graveyards, where vegetation has overgrown the crumbling stonework, there is usually no shortage of colour and these are often the best places to work—the tumbling vegetation and rotting iron and stonework can make beautiful pictures. Indeed some old graveyards are havens for wildflowers deep within the city and some graveyards are worth a visit for the flowers alone.

Although details make the most immediately attractive shots in graveyards, other compositions are worth trying. In many old graveyards, for instance, the rows of similarly shaped headstones can make attractive patterns. A frontal shot showing just a few head-



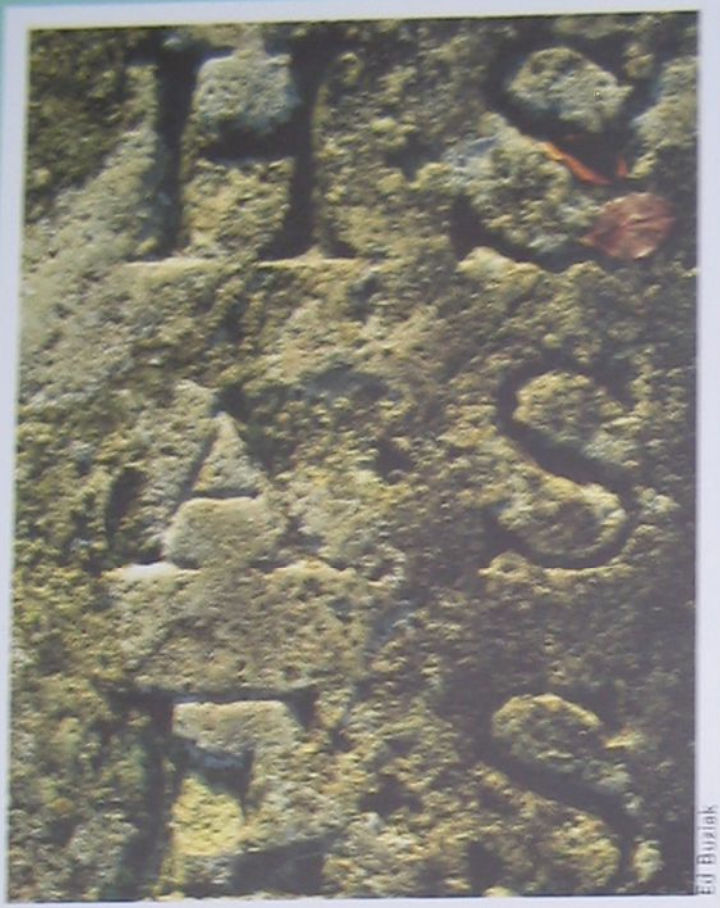
John de Visser

Tombstone *An isolated tombstone can make a poignant picture—use a wide angle lens to give a sense of the space beyond*

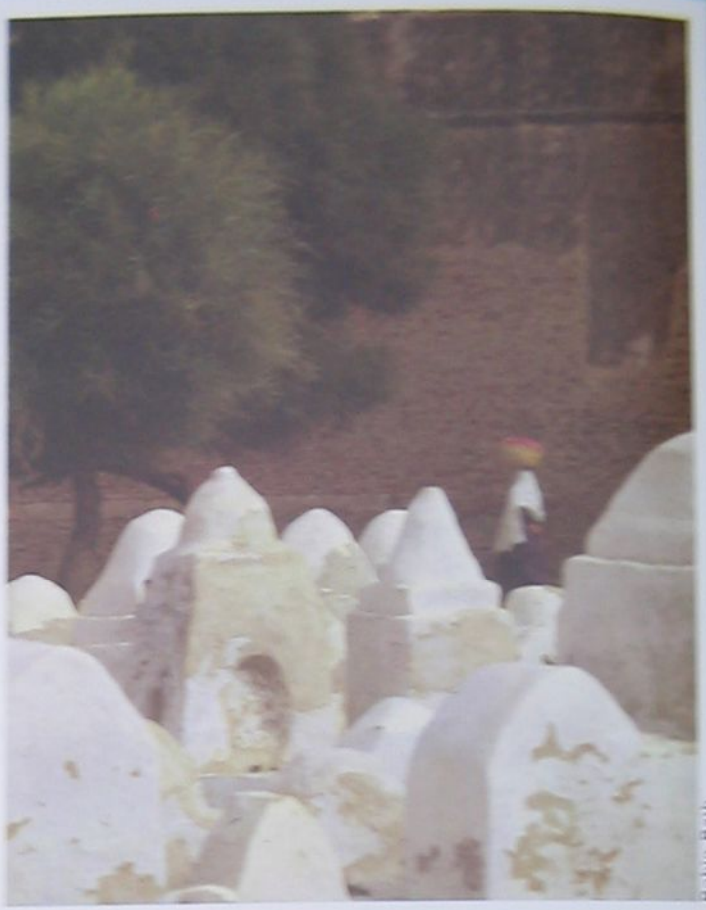
Heavens above *Look for the small but often graceful statues in Christian cemetaries. But remember to frame against a plain background*

Vautier/de Nanxe

Flaming head *Traditional ethnic funeral processions are often colourful, lively events and closing in on details can produce interesting images*



Ed Buziak

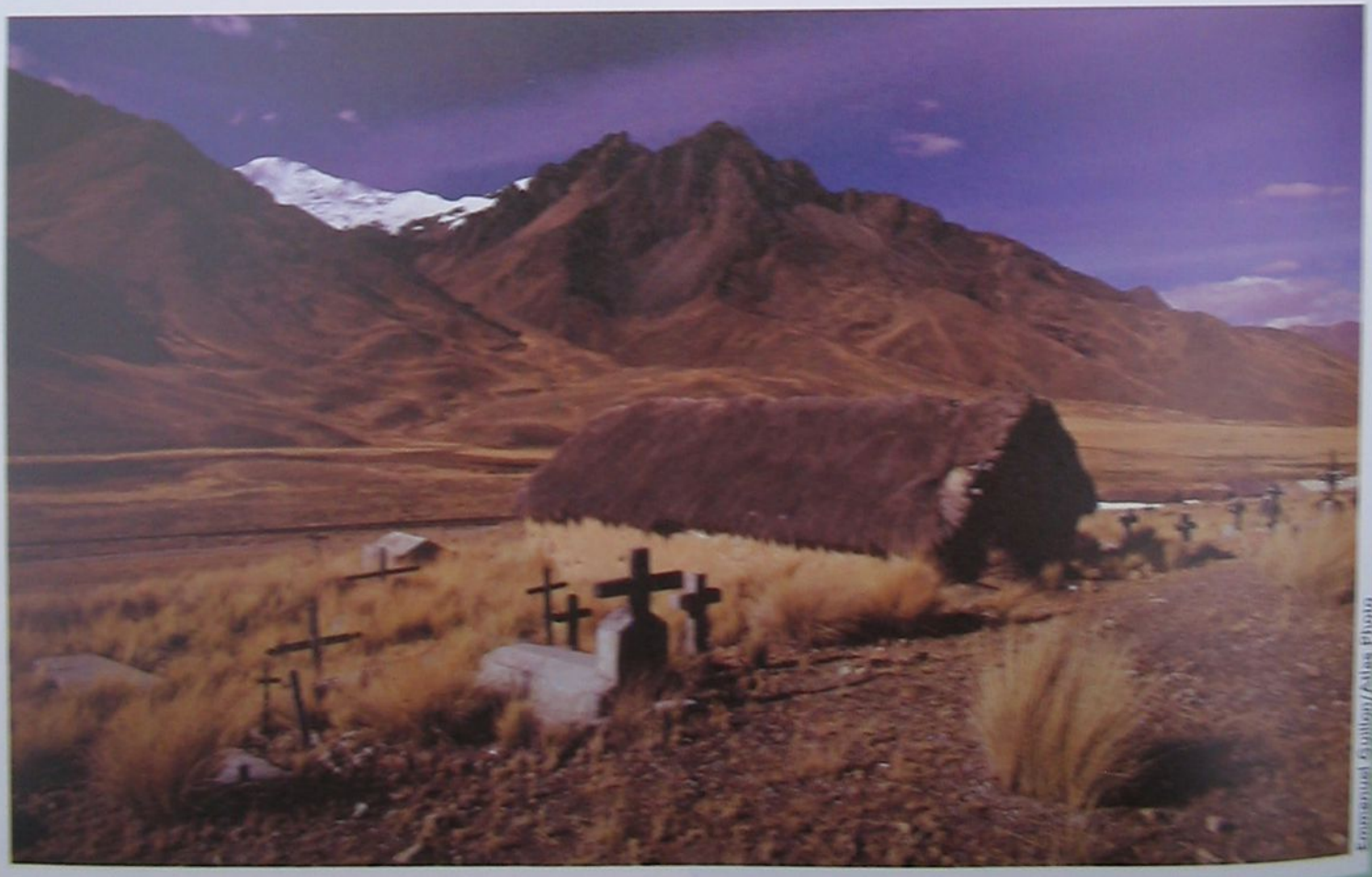


Robin Bath

Dead letters *To bring out the rich texture of crumbling, lichen covered stone, shoot in dull overcast weather*

Thatched chapel *Small cemetaries can make evocative foregrounds in sparsely populated landscapes*

Whited sepulchres *It is worth waiting for a little human interest to add colour and life to a pale scene*



Emmanuel Guillon/Alex Photo

Vautier/de Nanxe

Last respects *Ethnic funerals are eyecatching and often moving, but require a tactful and considerate approach*

Graven image *The haphazard tumble of headstones can make an attractive pattern but a splash of colour is needed*

Robin Laurance

stones overlapping at different levels in the picture or a long perspective shot along a row can be very effective—particularly where just one or two leaning or unusually placed tombs break up the symmetry.

In modern war graves, the pattern element can be even stronger and all the identical crosses are arranged in lines with military precision against a pristine background of cut grass. There are certain points—usually near the corner of the graveyard or from a high vantage point—where the arrangement becomes a striking pattern of diagonals. A shot of only part of this can give a strong impression of the scale and enormity of the scene.

It is worth bearing in mind that some of the best shots of the graveyard can be taken from beyond it. An interesting or an unusual viewpoint can often make a successful picture. Try climbing a tree, or the church tower, or a little way up the wall to shoot down or across the tombs. In Hong Kong, for instance, where massive graveyards spread over the steep, terraced mountainsides, the most effective photographs are often those taken from some distance away through a telephoto lens. The compressed perspective of the telephoto makes it seem as if the graves are piled one on top of the other.

In Hong Kong, just like in many cemetaries in North America, skyscrapers form the background to the tombstones. With careful framing, you might be able to show the shape of the tombstones echoed in the city. Grave-

yards can be photographed in their context in many other ways, of course. In isolated mountain regions, for instance, a small graveyard might make an evocative counterpoint for a general landscape shot.

Graveyards can be extremely poignant places and there is a great temptation to try to introduce this into your shots. Small abandoned wreaths or lonely figures tending graves have been done to death, but there are other approaches. Try a long exposure while shooting foreground foliage to produce a disturbing, unearthly effect. For a more nostalgic image, you could use a filter a size too small for the lens, to introduce vignetting.

One of the most striking features of many older Christian graveyards is the lingering rather oppressive atmosphere. In a few places, particularly in the industrial cities of the nineteenth century, the style of monument could be described as doom-laden Gothic. You can really go to town in trying a moody, heavy approach to bring out this aspect.

Of course, cloudy, overcast weather with plenty of lowering clouds is ideal for this type of shot—if the sky is too light you can always use a graduated filter to darken it up. Wet weather is usually best, though, because it can give clear, high contrast images with deep blacks and bright highlights.

This type of shot usually needs unusual angles to create some sort of tension. The obvious shot is from a very low viewpoint using a wide angle lens so that the verticals of tombstones converge powerfully—with dark, wet shiny stone and heavy skies, the result is predictably dramatic. Shots like this are most effective on black and white film.

But do not just stick to the obvious shot—try out all kinds of different angles and approaches to achieve a similar effect. A wide angle lens with its sharp convergence is clearly a useful device—a dark very close foreground object can always be made to loom disturbingly. Unusual views of the tombstones and statues that give strong diagonals may be equally effective—so might unusual camera angles. Be prepared to experiment—you may not even need cloudy weather to produce the mood: a greatly underexposed shot into the sun between two gravestones might give a dramatic moonlight effect.

You can also create mysterious effects by underexposing the background while filling in a foreground tombstone with a correct flash exposure. This technique is also a simple and effective way of drawing attention to a detail and suppressing a confusing background. You could even, in some abandoned graveyards, go back at night and try to create some ghostly images. A long time exposure—with the camera firmly on a tripod—of some suitably bizarre or haunting part of the cemetary could be complemented by a ghostly figure floating across the frame during the exposure. Briefly illuminate a friend in appropriate dress with a weak flash (or even a torch) and then move him or her to a various positions during the exposure to make the figure appear to move across the frame. If you can avoid lighting the feet, the 'ghost' will appear to float above the ground.

Vautier/de Nanxe

Floral tribute *Overcast weather is ideal for adding a little mood to the shot. It also helps to give good colour saturation*

Even in old Gothic style graveyards, though, there are many other approaches you can take and it would be a mistake to go for mood shots alone. And other graveyards may call for an entirely different treatment.

Graveyards in Moslem countries, for instance, are often considerably less sombre than their European counterparts. Obviously the climate helps to create this lighter atmosphere but graves are often far less elaborate and far brighter. Many graves in the Middle East, for instance, are plain white pinnacled clay structures with little ornamentation. Their colour, their simple shapes and the climate make them ideal for an almost abstract approach. Shot against a deep blue sky or the desert sand, they can be very photogenic. But it is important to keep the composition simple—either keep the background virtually featureless to give an almost surreal pattern, or look for background in shadow which contrasts with the plain white of the tombs. But for variety look for a splash of colour or a little human interest to enliven the shot.

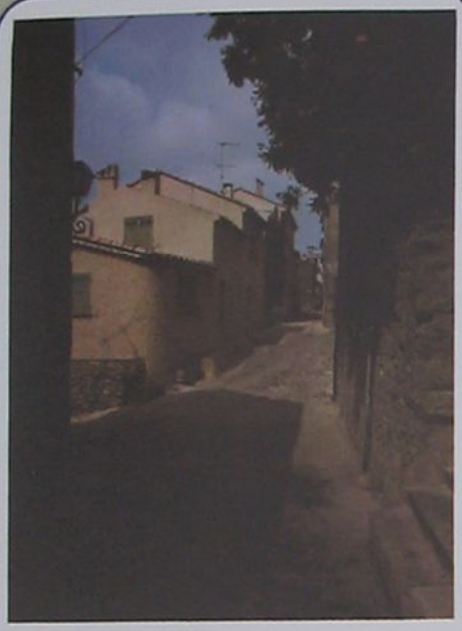
Wherever the graveyard, look for an approach that uses its characteristics to best effect—and then look for something completely different. In a graveyard full of tangled vegetation and crumbling iron and stonework that lend themselves to a pretty, wistful approach, get your pretty shots, and then look for hard, aggressive abstracts. They may not necessarily work, but, if they do, they will be unusual and original—always be on the lookout for something new.

A final point to remember is that many people are naturally sensitive about graveyards—so be careful that none of your photographic activities offend.

What went wrong?

Some holiday views

A picturesque scene is not enough to make a successful photograph—as Sergio Dorantes explains, viewpoint and composition are very important

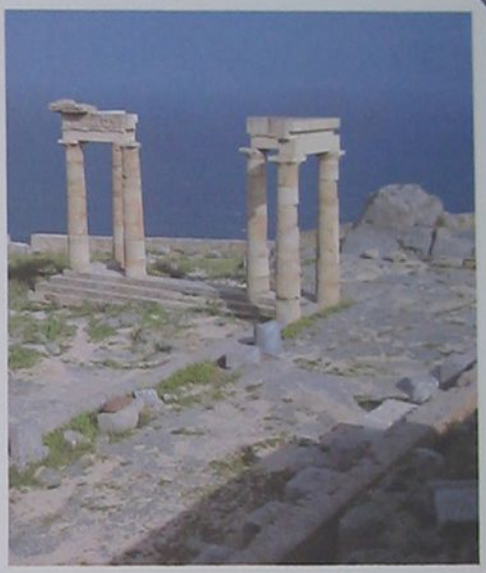


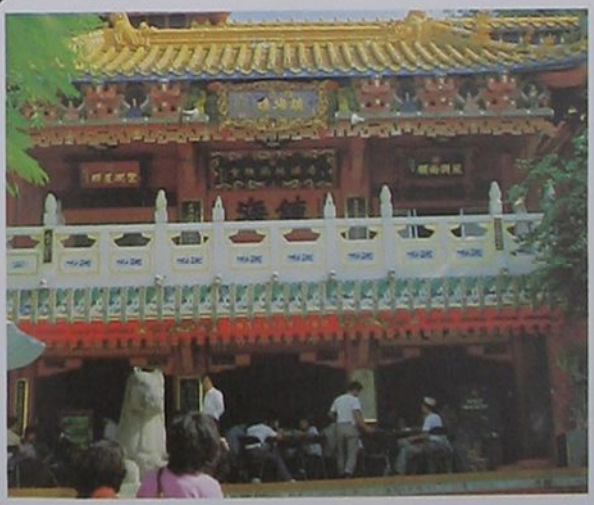
The above scene has many elements which the photographer could have used for a better result. One of the major rules of composition, that of the line which leads the eye into the picture, is broken by the side street which runs off the alley. Lighting is uninteresting, and the branches merge with the rooftops because the subject was not carefully isolated. The foreground shadow is too long, and distracts attention from the main subject—the alley itself. By shooting closer to the alley corner, most of the shadow could have been eliminated, thus concentrating on the main details in the scene. Precise composition is essential and with a static subject like this, you can make time to find the best viewpoint.

The location of this shot was the village of Gassin, Provence, in southern France.

Archaeological sites are always popular holiday subjects. This example offered an opportunity for an interpretation of classical architecture—the sky, the ocean and the columns could have been organized into a very graphic composition. However, some flaws have spoiled the image. The horizon is level with the top of the columns—an effect which gives unbalanced proportions to the picture—while the enormous expanse of foreground has reduced the apparent size of the columns. Further, there is nothing in the picture to give scale and dimensions so the viewer does not know if the columns are short or tall. By standing closer, the photographer could have placed the horizon in the lower part of the frame, filling most of it with the sky. This would have given a much more dynamic view of a potentially dramatic subject.

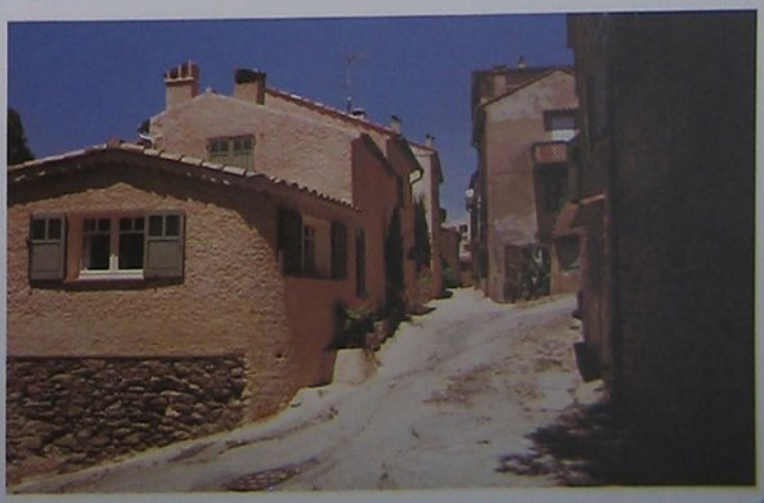
The temple is at Lindos, on the Greek island of Rhodes.





This picture is typical of scenes where the intricate detail tempts the photographer to try to show the whole scene rather than just one of its many aspects. Lack of a strong focal point makes the picture confusing, and has wasted a potentially good image. With subjects like this, it is better to isolate part of the scene which conveys the character of the place. Here the photographer could have aimed at specific details—a closer viewpoint or a telephoto lens would have shown the expressions on people's faces, details of the exotic architecture or the writing on the walls. With exotic subjects like this, make the most of quaint features.

Another interpretation of the scene shown top left, here the photographer has attempted to take a more pictorial image. The dominant foreground and the tree's branches have been left out of the frame, and a tighter, more balanced arrangement of the subject matter has produced a definite focal point—the end of the alley. However, once the eye has successfully been led to the focal point of the picture, it stops abruptly and looks for a point of interest—something to attract the attention of the viewer is needed. A person, an animal, or any object would have provided this missing focal point Lighting is also far from suited to this subject—the strc ,g midday sunlight tends to disguise, rather than bring out, rendition of the buildings' shape and texture, while the exposure has almost bleached out the ground. A softer light, such as that of early morning or late afternoon, would have given much richer, warmer colours to the roofs, the walls and the ground, enhancing the subject and creating a quaint and appealing image. When composing your shot, therefore, it is best to keep an eye on all elements—lighting in a photograph can be as important as composition.



Projection screens

Often the last item to be considered in projection set-ups is the screen itself. But its convenience of use and quality is of paramount importance especially if you want to get the best from the rest of your equipment

One of the least considered items in the presentation of slides is the projection screen. Even photographers who take great care to get top quality transparencies and spend a lot of money on a good projector and lens, tend to ignore the quality of what they are projecting the pictures on to.

Improvising a screen with surfaces such as white paper, card, painted board or wall, and so on, may be adequate if you want to preview the odd slide sequence. But there are many problems with such surfaces. Their uneven textures and impurities become accentuated and interfere unfavourably with the projected image. Also the lack of brilliance and colour saturation, particularly when used in a room which cannot be completely darkened can be very disappointing.

So for best results when projecting slides it is essential to have a proper screen. Also it is important to have the type of screen which best suits your needs, the main considerations being size, material and type of construction.

Rolf Cornell

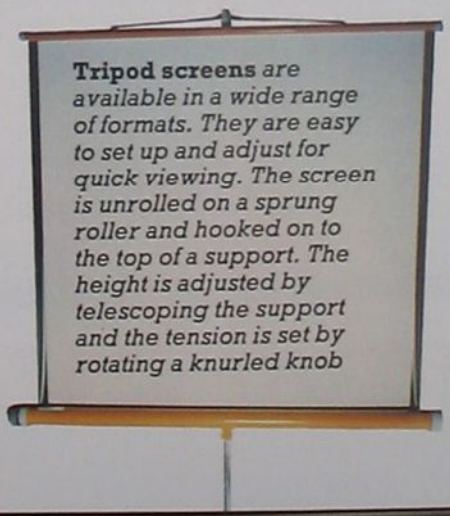
Daylight screens *Even in daylight this type of screen gives a much clearer, brighter image than an ordinary matt screen (left)*

Practical considerations

For practical reasons the most immediate concerns are construction and size. It is seldom possible to have a permanent projection set-up so this restricts your choice of screen to those types which can be stored easily and erected quickly.

For this reason the most popular type is the tripod screen. This consists of a cylindrical metal or plastic tube hinged at the centre on a telescopic stand with folding legs. When stored, the screen itself is wound up inside the tube with the aid of sprung rollers. When the screen is erected, these rollers help to keep the material taut to give a completely flat surface. Even so, some models have a knob to stretch the screen after erection. This is a useful feature as the sprung rollers tend to become slightly less effective after a few years of use.

Once the screen has been pulled out of the slit in the tube and hooked over the top of the stand, the height can be adjusted by releasing either a wingnut or pressure plate and extending the telescopic section. It is important that the locking device should be secure—you do not want the screen to collapse halfway through a slide show.



Tripod screens *are available in a wide range of formats. They are easy to set up and adjust for quick viewing. The screen is unrolled on a sprung roller and hooked on to the top of a support. The height is adjusted by telescoping the support and the tension is set by rotating a knurled knob*

Dave King/screen courtesy of Photopia

These screens are available in sizes ranging from 50 cm to a massive 300 cm in width. However, very large tripod screens are expensive and, because of their freestanding construction, have a tendency to sway to one side. This makes it difficult to keep them squarely aligned in front of the projector.

For maximum stability, a boxed screen type is a better alternative. The screen is wound inside a long, narrow box which is placed on the floor or a table. The screen is erected with the aid of folding stretcher arms, one each side, and kept taut by sprung rollers built into the box. Although heavier and more cumbersome to manoeuvre, it is very easy to set up the screen single handed. If storage is not a problem this is an ideal screen.

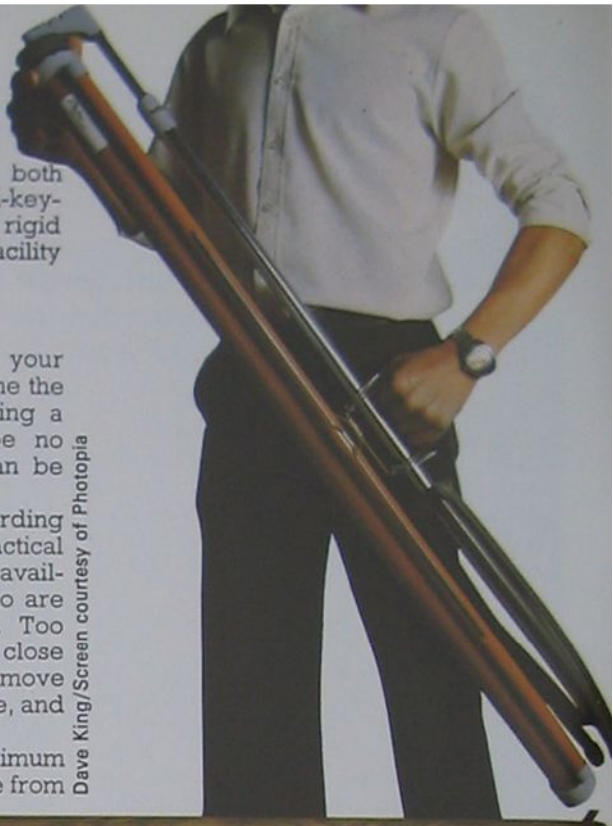
For a permanent set-up, a rigid screen can be the best and most economical choice. Some are made by stretching material over a lightweight frame and others by mounting the material on a thin opaque base. One advantage is that rigid screens can easily be tilted forwards to avoid *keystoning*, which is the widening at the top of an image caused by tilting the projector upwards. Some of the more expensive screens, both rigid and collapsible, have anti-keystoning devices built in. But with rigid models it is easy to provide this facility even on inexpensive screens.

Size and surface

The permanence or otherwise of your projection set-up can also determine the size of screen you choose. Leaving a small screen in position may be no problem whereas a large one can be inconvenient.

But the main consideration regarding screen size, apart from the practical limitations imposed by the space available, is the number of people who are likely to make up the audience. Too large a screen positioned too close forces the people looking at it to move their eyes when viewing the picture, and this can be very tiring.

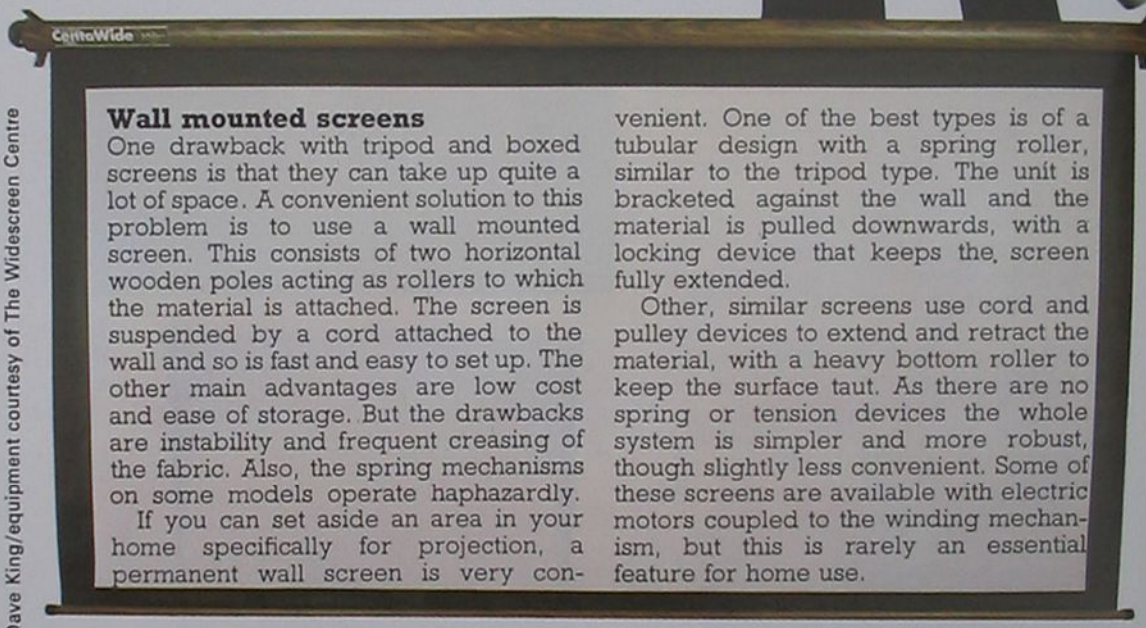
As a general rule, the maximum screen width should be the distance from



Dave King/Screen courtesy of Photopia

Portability *is one of the main advantages of tripod screens. They are also convenient for previewing slides quickly in a small workshop, or for projection in a small room where there is no space to store a screen permanently. The tripod is not detachable, but it folds with the screen*

Wide wall screen (*right*) *Designed for projection of Cinemascope format movies, or slides photographed and projected using an anamorphic lens. The widescreen format has a small but faithful following, but is comparatively costly*



Dave King/equipment courtesy of The Widescreen Centre

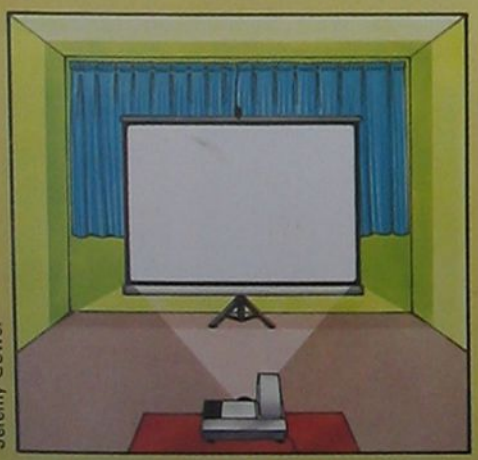
Wall mounted screens

One drawback with tripod and boxed screens is that they can take up quite a lot of space. A convenient solution to this problem is to use a wall mounted screen. This consists of two horizontal wooden poles acting as rollers to which the material is attached. The screen is suspended by a cord attached to the wall and so is fast and easy to set up. The other main advantages are low cost and ease of storage. But the drawbacks are instability and frequent creasing of the fabric. Also, the spring mechanisms on some models operate haphazardly.

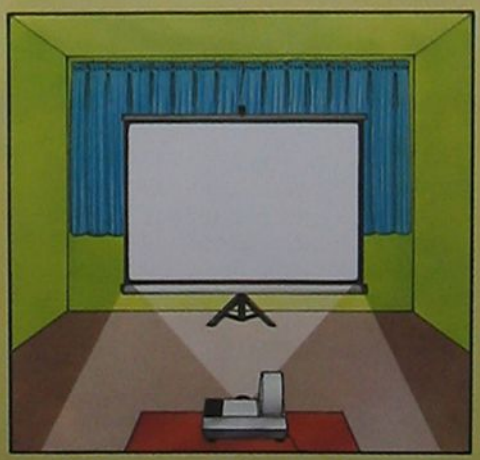
If you can set aside an area in your home specifically for projection, a permanent wall screen is very convenient. One of the best types is of a tubular design with a spring roller, similar to the tripod type. The unit is bracketed against the wall and the material is pulled downwards, with a locking device that keeps the screen fully extended.

Other, similar screens use cord and pulley devices to extend and retract the material, with a heavy bottom roller to keep the surface taut. As there are no spring or tension devices the whole system is simpler and more robust, though slightly less convenient. Some of these screens are available with electric motors coupled to the winding mechanism, but this is rarely an essential feature for home use.

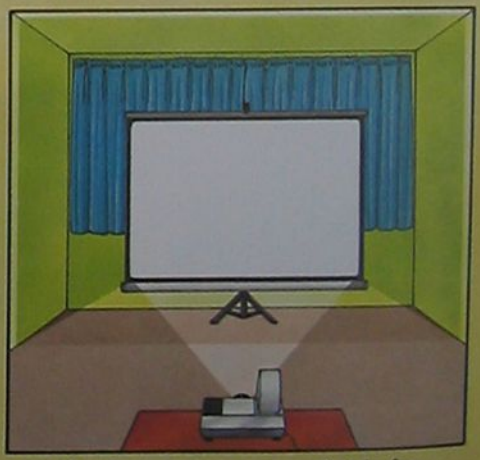
Screen types and viewing angles



Matt screens *are less brilliant than other types but they have an extremely wide viewing angle*



Beaded screens *have a narrow viewing angle and are ideal for small audiences or low output projectors*



Lenticular screens *are suitable for large audiences in a wide, undarkened room but are best in low light*

Jeremy Gower

the screen to the person closest to it. The minimum width should be the distance from the back of the audience to the screen divided by six. The difference between the minimum and maximum sizes calculated in this way allows for some flexibility and compromise.

The size of the audience also has some bearing on the material from which your screen should be made, as do the conditions of viewing. A variety of surfaces can be used which affect the viewing angle, and the brightness and sharpness of the image.

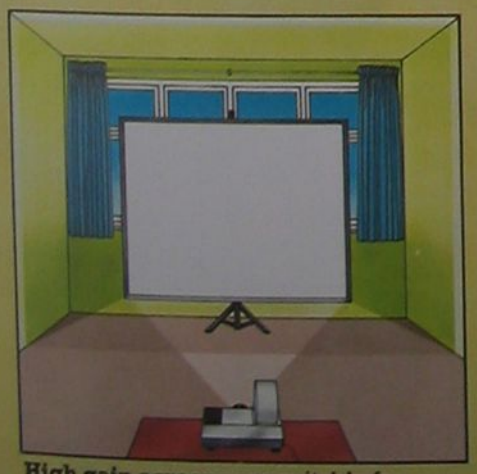
A plain, matt white surface gives a reasonably bright image, but only if the room is completely dark. Any light leaking through curtains, for example, greatly diminishes the image brightness. In complete darkness contrast and colour rendition are very good and sharpness is superb.

Another advantage is that plain screens allow wide seating arrangements as the light reflected from them is not directional. So in ideal conditions the simplest screen is actually the best.

A surface which does not need a completely darkened environment is the *beaded* screen. This is covered with thousands of tiny glass beads which concentrate and reflect the light back in one general direction. This means that the image is very bright when seen from a fairly central position. The brilliance rapidly falls off when viewed from an angle (further than about 35° off the projection axis).

There is some loss of image sharpness with a beaded screen, and photographers who are particularly concerned with sharpness do not readily accept the image quality reflected by this type of surface. Other disadvantages are that the surface is extremely difficult to keep clean, and the material becomes brittle in time leading to small bald patches.

Pearl beaded screens—a more recent improvement—use slightly different coatings with more flexible plastic based beads, and so tend to be longer lasting.



Jeremy Gower

High gain screens *are suitable for small audiences in a narrow room which need not be darkened*

Lenticular screens have a textured surface designed to make them less susceptible to stray light. You can recognize a lenticular screen by its ridges. It gives a very bright image and allows a wide viewing angle. The quality of the image is only marginally inferior to that of a matt white screen. So when it is impossible to black out a room completely, a lenticular screen is often the best choice of surface.

Special surfaces

When the viewing room is bright, it is necessary to use a screen with a metallic surface to reflect as much light from the projector as possible. Of this type the most common is the metallic or silver lenticular surface which has largely replaced earlier flat silver types, as the latter had very narrow viewing angles.

Metallic lenticular screens give outstanding brilliance together with very rich colours, and the viewing angle allows wide seating arrangements, up to 50° either side of the projection axis. If you buy one of these screens, make sure it has a good screen tensioning device as these screens tend to curl.

True daylight screens, also called *high gain screens*, combine silvering with a beaded surface. They give a remarkably bright image even with the room light on or the curtains open. One of the best, made by Kodak, uses sheets of pressed and bonded aluminium and is so bright that it is actually uncomfortable when used in darkness. It needs to be permanently installed as it is rigid. It is also quite fragile and expensive, and so is really only for specialized use.

Other special materials are available for back projection (see page 1156). These are translucent and, with the right type of set-up, allow viewing in fairly bright conditions. Over the years the development of the translucent screen has gone from ground glass to a lighter, thinner, brighter and more evenly illuminated plastic material. For larger screens specially treated fabrics which give good overall illumination are preferable. If you are making your own back projection set-up it is a good idea to experiment with a range of materials to find which is best for a given situation.

The main points to bear in mind when buying are size and quality. A screen too large is a waste of money. Make sure the material from which the screen is made has an opaque backing. Dealers occasionally offer cheap screens with a plain or rigid white surface without backing which allows light to filter through from the back, lowering colour saturation.

You may find some of the surfaces and materials mentioned here difficult to obtain. The availability of the different types of screen is extremely variable, so finding your ideal screen may not be as easy as it seems. In addition, showing your transparencies to their best advantage while providing good viewing conditions for your audience may involve some sort of compromise.

Masked screens *are versatile, portable screens that can be masked down from Cinemascope to smaller sizes*

Masking is achieved by placing vertical and horizontal strips along the sides and top of the screen

Dave King/equipment courtesy of The Widescreen Centre

The smallest size is achieved by using more vertical strips. A range of formats is formed in this way

Assignment

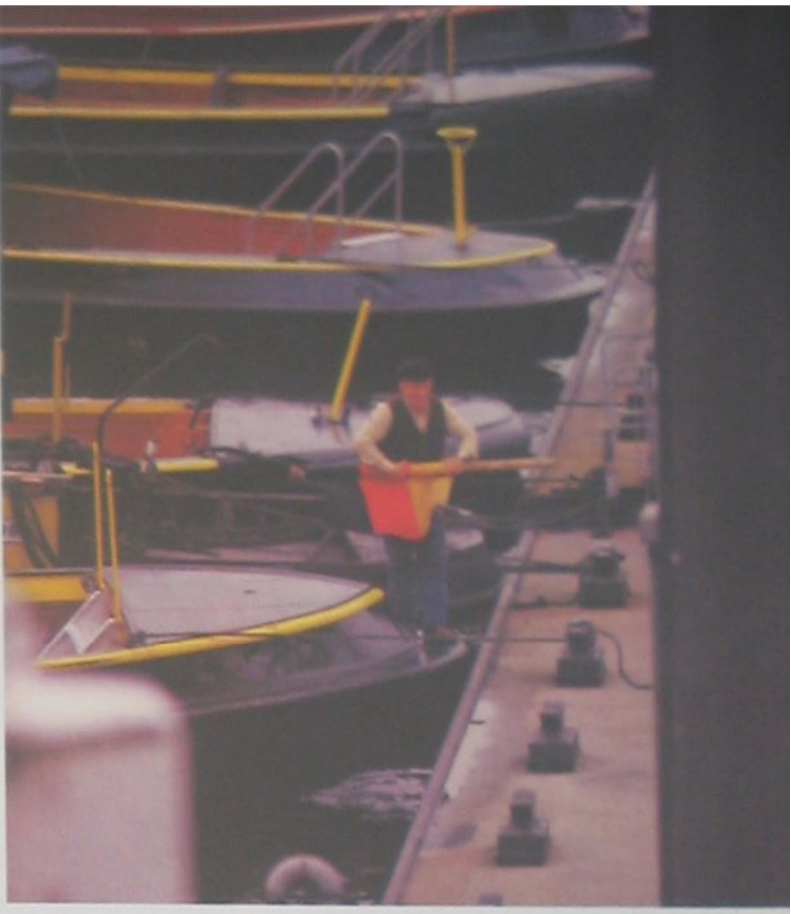
On the waterfront

A feature of many coastal towns and cities, the waterfront, with its everyday hustle and bustle, offers plenty to shoot. But, as our assignment photographer George Wright shows, a telephoto is essential

Thronging with the activities of towering cranes loading and unloading, lorries discharging goods, bustling tugs fussing over huge ships from the high seas and dockworkers scurrying everywhere, a commercial harbour offers plenty to photograph. Indeed, although lack of material is certainly no problem it can be difficult to decide just what to select in a day's shooting, as George Wright found when he visited the waterfront in Hamburg.

Public access to such places is usually limited so the choice of lens is a primary consideration and an important constraint. Though George took along a full range of equipment almost all his shots were taken with telephotos—105, 200 and 300 mm. Extensive use of long focal length lens necessitated shooting from a tripod—particularly as the day was overcast and dull. This type of lighting tends to produce blue casts on colour transparencies, so George fitted an 81A

Painting the hull *Here, a 300 mm lens allowed George to shoot across from one harbour wall to another*



Tug *The 300 mm lens filled the frame with the main subject (above left).* **Warehouse** *To reveal the detail of the scene, George used a 105 mm lens while an 81A added warmth to the brickwork.* **Flag** *The activity of this man would have passed unnoticed if a standard lens had been used instead of a 200 mm telephoto.* **Silhouette** *An aperture of f/5.6 on the 300 mm telephoto rendered the cranes a vague blur, emphasizing the silhouette.* **Cranes** *To exaggerate the shapes George exposed for the sky.* **Coloured tugs** *A 200 mm lens isolated colours from the dull surroundings*

George Wright

warming filter to the lenses to counter it.

Shooting from long distances, George exploited the characteristic foreshortening effect of long focal lengths to give extra impact to his photographs. An example of this can be seen in the shot of the old man with the background cranes seemingly looming over him. The telephoto effect juxtaposes the foreground and background elements—suggesting the past working relationship between the retired worker and the machinery. The image works particularly well because George chose an aperture which rendered the cranes as indistinct but recognizeable shapes. A wider aperture would have blurred them beyond recognition, while a sharper rendering from a smaller aperture would be distracting.

Improve your technique

High speed flash

Modern computer flashguns give a very brief but intense light. You can use this feature to stop action which normally happens much too quickly for the unaided camera, or eye, to see

Bullets frozen in flight, balloons bursting, a boot kicking a football—these subjects make fascinating pictures simply because they show clearly things which occur too quickly for us to see. High-speed photography has made it possible to capture these moments but, until recently it was out of reach of the photographic amateur, because of the expense of the highly sophisticated equipment that was needed. But the introduction of automatic 'computer' flashguns has provided a handy source of the very brief, intense flash of light that is needed to stop super-fast action.

Placed close to the subject, these units produce a very short flash almost as a by-product of their exposure control system. This provides the basis for your own work in high-speed photography.

How they work

The idea of using a flash to freeze motion is not new—William Fox-Talbot photographed a whirling newspaper using this method as long ago as 1851. Modern electronic flash units have just made it a great deal easier.

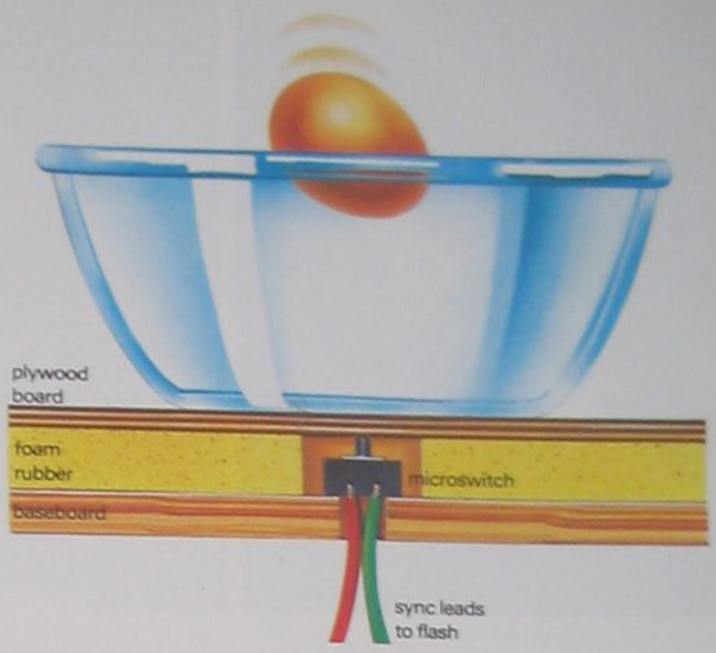
G. I. Bernard/Oxford Scientific Films

Prairie splash *High speed photography can produce dramatic pictures from the most mundane subjects, such as this shot of a prairie oyster in the making*

In a flap *A computer gun, used with a fairly wide aperture, gives a fast recycling time allowing you to take several shots of a moving object*

Fleming/Parker

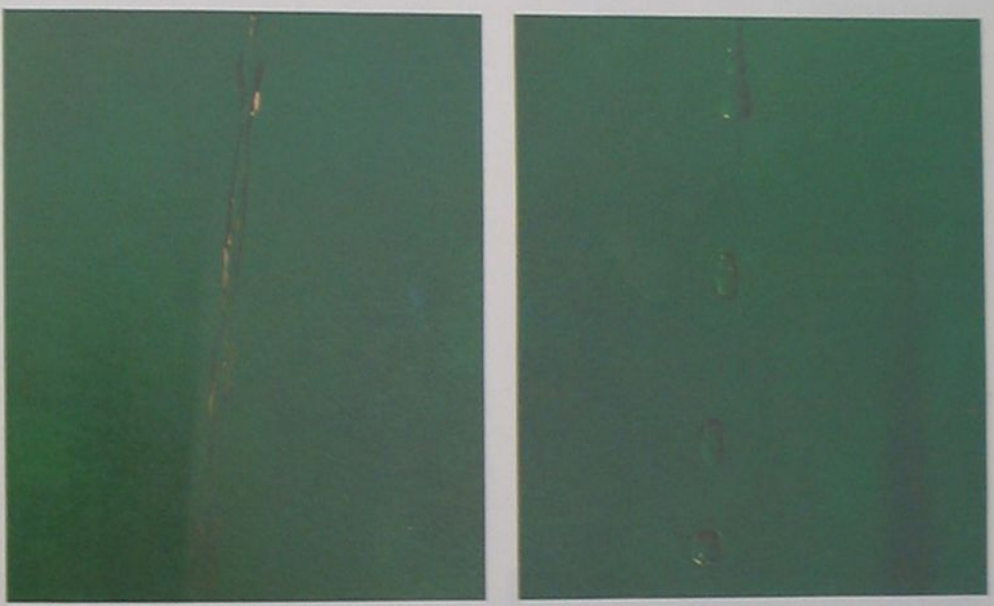
Output control *Some flashguns have controls which reduce the flash output, either built in or, as in this case, as an accessory. Lower output gives a shorter flash duration*



Advertising Arts

Breaking eggs *The switch which fires the flash is located in a layer of foam between two boards. The egg hitting the bowl depresses the top board which then presses the switch*

The flash duration of manual flashguns is fixed, and exposure is determined using the familiar Guide Number system, but with automatic models, exposure is controlled by changing the flash duration, and it is this feature that makes these units particularly suitable for arresting motion. With manual guns, the flash always lasts as long as the capacitor (see page 506) takes to discharge. This may be as little as 1/100 or even a 1/125 second, but this is not short enough for high speed photography. With an automatic gun, however, the flash can be cut off well before the capacitor is discharged and the flash duration can be reduced dramatically. In an automatic flash, a built-in 'computer' measures the amount of light reflected back from the subject. When this amount reaches a quantity which will give sufficient exposure for a particular film, then the light from the flash tube is cut off. At normal flash-to-subject distances, this cut off point is reached after about 1/1000 or 1/2000 second, but when the flash and subject are very close together, and a fast film and wide aperture are used, the flash is quenched much more quickly. It may only light the subject for 1/20,000 or 1/30,000 second. It is this short duration flash which makes possible dramatic action stopping pictures when the level of ambient lighting is low.



Frozen water *Both pictures were taken with the same flashgun used on its manual setting (left), the flash duration being 1/1000 sec and on its extreme auto setting (right) giving 1/30,000 sec*

Raj Kamal/Oxford Scientific Films

Some units have additional features such as half- or quarter-power settings, to allow for greater image control through aperture variation, or to cope with a greater range of flash-to-subject distances. Lower power is used with subjects close to the camera and the use of such a setting will probably give shorter flashes—1/25,000 sec is possible.

For successful high-speed work, the flash must not only be brief and intense, it must also take place at the appropriate moment in relation to the action being photographed. So a triggering device is needed to fire the flash at the right instant. As the camera shutter must be wide open when the event takes place, conventional synchronization is usually unsuitable and it is common practice to take this type of photograph by *open flash methods* where the firing of the flash does not involve the camera's shutter at all.

For open flash photography, the camera shutter is kept open for the duration of the action, using a locked cable release and the B setting on the shutter speed dial. The flash is then fired with an independent triggering device to briefly illuminate the subject at the right point in the action. Providing the room is sufficiently dark (with the

Squashed ball *This type of picture requires very accurate setting up to make sure the racket hits the ball directly in front of the camera*

Dr Harold Edgerton/Science Photo Library

Caught and shot *To photograph a pellet hitting a metal plate, a target is made from two thin plates acting as the flash contacts. When the pellet hits the target it either passes through, and so completes the flash circuit, or buckles the plates so that they touch. By having the flash unit close to the target the output needed is reduced, giving a shorter flash duration*

Advertising Arts

curtains drawn and the lights off) only the moment when the flash is fired should register on the film. The trigger can simply be a microswitch arranged so that the subject sets off the flash itself at the right moment. This is usually fairly easy to improvise, and an example is given below.

When using this technique, it is important to ensure that the flash fires only once while the shutter is open. With simple automatic flashguns there is no problem: any power not required for film exposure is simply 'dumped' in a black painted flash tube within the body of the gun. The excess energy is therefore dissipated as heat. When one of these flashes is used at a short distance, all of the power stored in the capacitor is used up each time the flash is fired, and the recycling time is always the same—about five to ten seconds—regardless of the flash-to-subject distance.

With energy-saving or thyristor flashguns, however, unused energy is retained in the main capacitor, where it is stored for the next flash instead of running to waste. The recycling time is therefore shorter, and when the subject is very close to the flashgun, it may be almost instantaneous.

In practice

A fairly simple subject to photograph with open flash techniques, is a raw egg, in its shell, being dropped into a bowl. The aim is to photograph the egg as it smashes on the bowl bottom.

The flash head is placed at only a short distance from the subject—as close as 60 cm—and both the subject itself and the background (the inside of the bowl) are light in colour. Furthermore, quite a wide aperture is used so that little light is needed to light the shot—though this sometimes creates depth of field problems.

The flash unit and the camera must be set up so that they look down into the bowl and, for reasonable modelling of the egg when broken, the flash-head should be placed at about 90° to the camera axis.

For a subject like this, you might be able to achieve acceptable results with synchronized flash, relying on your ability and quick reactions to release the shutter at the precise moment of impact. But you are more likely to get good results with a minimum wastage of eggs, film and time, if you set up a trigger mechanism under the bowl. The force of the egg hitting the bottom of the container can be used to set off the flash. You can easily build a suitable device from bits of scrap wood, a few light springs or foam plastic, and a microswitch which, when pressed, makes an electrical contact. Connect this switch to the flash unit through a suitable lead (such as a modified flash extension lead) and mount it button uppermost, on a piece of board. Another board is supported over the top of the switch, using springs or foam. The slightest pressure on the upper board, with the bowl on top of it, operates the microswitch and fires the flash. You can easily test the device by dropping a robust substitute for eggs into the bowl. The sensitivity of the device is easily controlled by varying the thickness of the foam layer or by using a different material which is more, or less, rigid.

The results with this system can be surprisingly good and there are many fast moving subjects you can try to capture on film. For example, if you tether an inflated balloon on top of the trigger platform, a dart dropping on to it can create sufficient pressure to fire the flash, if you adjust the system to the limit of its sensitivity. Alternatively, the

Dr Harold Edgerton/Science Photo Library

Bursting balloons *These balloons are at different stages of being burst by a pellet and show how the flash synchronization affects the object's appearance*

whole apparatus can be stood on its side, to photograph a fist pounding into a punchball. However, for many subjects, such as arrows or airgun pellets, impact triggering is inadequate. Although some people use sophisticated electronic methods, you can still improvise a fairly simple trigger providing you do not mind it appearing in the picture.

For example, to photograph an airgun pellet passing through a thin sheet of metal you can use a sandwich made up of two thinner sheets, separated by an equally thin layer of an insulating material in the corners of the sheets. Use paper or thin plastic sheet of the type used in scale models for the insulation. Each conducting metal layer is connected to one of the flash lead wires, and when the pellet passes through the target, the two outer layers are briefly connected by the metal pellet and the flash fires. Alternatively, the flash may be fired by the plates buckling and so coming into contact with each other.

Fleming/Parker

Making the exposure

As with any other picture, attention to detail and careful photographic technique are essential in high-speed photography. If you are using projectiles such as darts or airgun pellets, keep the camera well away from the action and make sure there is something to absorb the flying object—such as a sandbag or a solid piece of wood. Remember that, for exposure determination, it is the distance from the subject to the flash, not the camera, that counts. Set the camera up on a tripod, and accurately line up all parts of the subject before focusing the camera. You may want to use a telephoto lens if camera and subject are kept well apart for safety reasons. Darts, falling eggs and bullets always travel in predictable paths, so you should have little difficulty deciding where to focus. If the flash has a choice of power outputs, set it to the lowest power—that is to say, the widest aperture—as this gives the shortest possible flash duration. Pay attention to the instructions packed with your particular flashgun, because there will almost certainly be a minimum distance specified. If the flashgun and subject are too close, your pictures will be overexposed.

Read off the required aperture for the film speed you are using from the scale on the flashgun, and make a series of test exposures. You can do this on black and white film, so that you can make an on-the-spot check on exposure before shooting in colour. This black and white test film needs only to be developed and quickly fixed before it is used for exposure evaluation—washing, drying and printing are unnecessary. If you have a flashmeter, or a camera which can be used with Polaroid film, these provide even better exposure checks.

Even after an exposure check, you should still take care to bracket your pictures at one, or half stop intervals over a two stop range, because of the effects of reciprocity failure (see panel).

Sophisticated triggers

It is not always possible for the subject of a high-speed flash picture to trigger the exposure directly, and a number of indirect triggering methods are commonly used. One of these is a *sound trigger*, which fires the flash when there is a loud noise. This system is ideal for photographing flying bullets, for example, because the noise from the muzzle of the gun can be used to fire the flash. A microphone is used to pick up the sound, and a special circuit closes the flash contacts after a short delay. The length of the delay—and the distance that the bullet flies before the flash fires—is varied by changing the distance between microphone and the gun.

Sound triggers of this type are sometimes available in shops, but they can be built quite easily by someone who has experience of electronic circuit design and construction.

Another convenient way to fire the flash is to arrange for the subject to break a beam of infrared radiation which lies in its path. This technique is particularly suitable for wildlife photography, where the exact path and direction of the subject cannot be accurately predicted. A fuller description appears on page 1304, and a subsequent article covers the necessary equipment in more detail.

Reciprocity failure

When exposures are very short, film does not behave as you would expect it to, and a phenomenon known as reciprocity failure becomes a problem. This is more often encountered when exposures are very long, and its causes are discussed on pages 466 and 467.

In practice, reciprocity failure leads to underexposure when you use an automatic flashgun at short distances. To compensate, you should open up the lens aperture slightly more than the chart on the flashgun suggests, and if your camera is loaded with colour film, you may also have to use a colour correction filter.

The exact amount of extra exposure varies from film to film—for example, at an exposure time of 1/10,000 second, Ektachrome 200 film needs an extra half stop. Colour correction depends on both film and flashgun, and can only be exactly determined by trial and error, although a good starting point is to use 10 units of yellow filtration over the flashgun or lens.

Creative approach

MOTOR SPORT

While motor racing is an exciting and glamorous sport, it does not automatically lead to eye catching pictures. To achieve these you have to combine creativity with technical expertise

Extremes of noise and speed, adrenalin pumping excitement and vivid colour all make a major motor race an unforgettable experience. The abundance of glamorous motor racing photographs that can be seen in magazines, books and advertisements is testimony that this sport is highly suited to the camera. However, it is all too easy for the inexperienced motor racing photographer to let the atmosphere and excitement deceive him or her into thinking that the images being produced are also exciting. Letting your camera's motor drive clatter away in harmony with the scream of angry engines may seem productive at the time, but, not only is it easy to end up with a large number of similar images, it is also common to find that technical faults have ruined many of the shots.

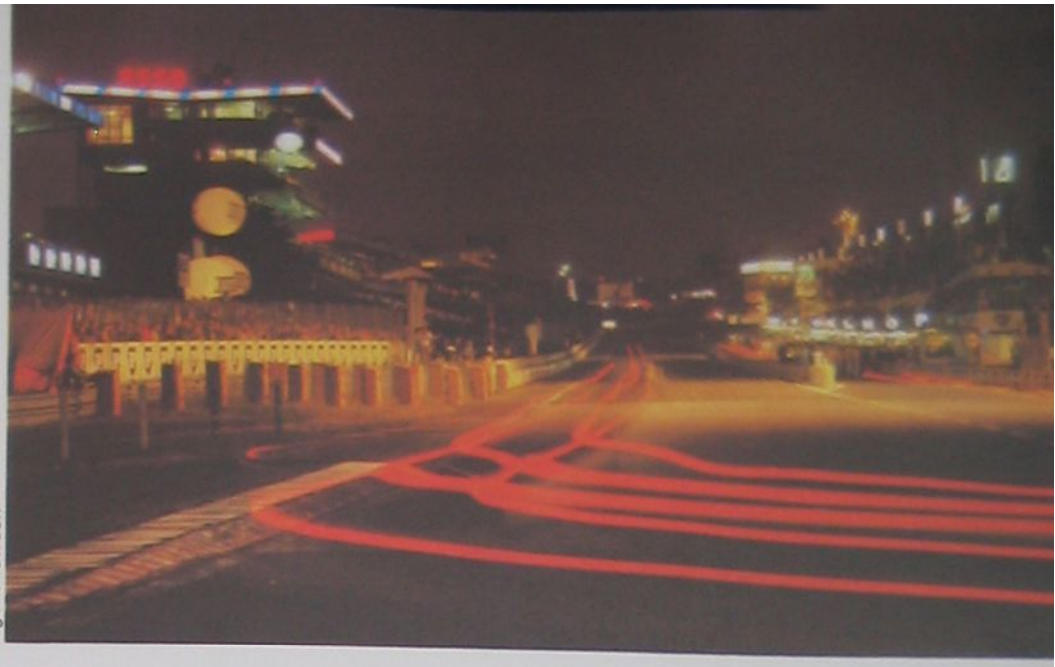
Successful motor racing photographs result from careful thought and planning as well as technical competence. If you want outstanding pictures, you must involve yourself with the race as a photographer, not a spectator. Whether the event is the 24 hour race at Le Mans, or a small club event, a photographer—amateur or professional—must work hard to produce impressive results.

The type of planning required always depends upon the nature of the motor sport you are photographing. Because of their immense popularity, Grand Prix races are very difficult to photograph—even for accredited professionals who have unlimited access to the track and pits. Finding and holding on to good viewing positions can be a nightmare and, for most purposes, less popular motor sports are more likely to yield successful results. Formula 2, 3, 4, Formula Ford, sports car races and rallies are all easier to photograph because there are fewer people around.

However, if the glamour of a large Grand Prix or GT event is what you really want to capture, there are many ways of improving your chances. For instance, it is always worth going along to qualifying or practice days before the main race to familiarize yourself with the circuit. There are still plenty of people around to generate the unique atmosphere of a major motor racing event, but there are not so many as to make movement around the circuit impossible. By arriving early in the morning, you may be able to make good use of sunrise or low, warm sunlight to produce an atmospheric study of the setting.

A pre-race day visit also gives you the chance to walk around the track and find the best viewing positions, noting foreground obstructions and distracting backgrounds. Be prepared to walk some distance—the best spots may be two or three kilometres from the grandstand. Look for ways of exploiting the individual features of a track—perhaps a bridge, a tunnel, or a background of buildings, hills or trees. This may mean standing way back from the high vantage point offered by a hill or a building. These can add an extra element to your shots, making the difference between a record shot and something creative.

When researching the best viewpoints it is generally a good idea to pay particular attention to the bends. By standing opposite the apex of a bend you will be able to get good head-on shots of cars coming towards you. They will probably go through the bend one behind the other and, by using a telephoto lens to compress the distances between them, very dramatic photographs can be taken. Study a map of the circuit to get some idea about many of the best positions but, remember that you will not be able to spot features like elevated vantage points. The height from which you view the cars will make a tremendous difference to the results. Look not only for high viewpoints to



Nigel Snowdon

Starting lap *A head-on shot offers a dramatic view—here, a 500 mm mirror lens exaggerated the tight formation of the cars and blurred the background.* **Trailing lights** *An endurance race is ideal for spectacular night shots using shutter speeds of several seconds.* **Close communication** *The pit areas allows a more intimate look at the sport as this study of isolation and technology shows (below)*

shoot down on the cars, but also for lower positions from where you are almost on the same level as the cars. A clear view into or out of a bend allows head-on shots or a rear view of the cars accelerating out of the bend.

As well as familiarizing yourself with the track it is also important to work out a schedule so that you can divide up your time between viewpoints, while giving yourself time for static shots of the pits, the cars, the drivers and even the spectators. One very useful scheme to adopt at crowded races is to pool positions with other photographers so that good viewpoints can be safeguarded at all times while another spends time 'roving'.

It is also useful to talk to experienced motor sport photographers or study photographs and magazines well before the event. This way you can learn about the pictorial possibilities of a particular circuit and what lenses may be needed to get the best shots. On a flat track, for example, you may find that longer lenses are needed—these, like motor drives or spare bodies can often be hired (see pages 1430). Long lenses of about 300 mm or more with relatively wide maximum apertures are ideal for motor racing and are even more versatile with a matched teleconverter to increase the focal length while still maintaining a high standard of contrast and sharpness. The unique characteristics of zoom lenses and mirror lenses can also be exploited in motor racing and it can be well worth hiring these items.

The range of lenses and motordrives available make SLR cameras ideal for motor racing shots, but you should not be tempted to burden yourself with too much equipment as this will restrict your manoeuvrability. A tripod, for instance, is of little use for motor sport, although for action shots with long lenses light and compact monopods can be invaluable. Metal camera cases are less convenient to carry at an event but they do have the advantage of offering something to stand on when needed.

Be prepared to use a lot of film when photographing a motor race and bear in mind that even professionals have to shoot many extra frames to allow for unsharp pictures—it is impossible to produce perfect shots on every frame,

Jerry Young

Leo Mason

John Dunbar/LAT Photographic

Hard cornering *Zooming during a slow exposure (1/15) can create a dynamic effect.* **On the grid** *A long telephoto is useful for isolating colour in groups of cars—it is not essential to show a whole car nor even the whole group.* **Top view** *Take advantage of any high point you can—the image (right) taken from an unusual angle makes an interesting frame filling picture. This shot was panned at a shutter speed of 1/250 second.* **Quick repair** *(lower right) A vivid illustration of the almost frenzied activity of mechanics around a rally car. Here, the camera was fixed to a tripod and fired at 1 sec. This recorded movement of the mechanics but kept the car sharp*

Peter Tempest

especially if you are experimenting with new techniques. Take along a range of films from a slow, fine grain film for good colour and sharpness to faster films that can be uprated if the light is really bad. Always be prepared to waste the last few frames of a roll to make sure you have the camera ready loaded with a new roll for an important stage of a race. To try out new techniques or hired equipment, remember that you can always practice on ordinary road traffic, especially for basic action techniques like panning and prefocusing.

While there are many other things to photograph, motor racing is primarily concerned with speed and movement so if you spend a whole day photographing static shots you will miss out on the basic element of the sport. In a similar way, by simply using the fastest shutter speed your camera offers, you will freeze all the movement of the car so that the photograph will lose any sense of the great speed involved. Fast shutter speeds are easier to manage and are good for 'safe' shots where you want to show fine detail, or where there is another element to give the shot impact—perhaps another car trying to take the lead. Faster speeds can also be used for head-on shots—especially with telephoto lenses when you want to compress a group of cars together or use a low viewpoint to capture a car emerging over the brow of a hill. A fast shutter speed is also needed if you want to freeze water or dirt flying from the wheels of a rally car. But if you want to take more creative shots, ones which give a sense of movement, the techniques are harder because slower shutter speeds have to be used.

One way of injecting a sense of speed into your pictures is to master the technique of panning. This is usually the best way of approaching a side-on shot and involves following the car along with the camera and using a comparatively slow shutter speed midway in the pan. If the movement is fluid and the car is in focus, the foreground and background will become a pleasant blur while the car itself will remain sharp. Slight blur will be recorded at 1/250 sec but for more dramatic results, try a slower speed.

These slow speeds can produce a very dynamic effect but for a more unusual image, try finding a colourful background. A blurred stretch of grass can provide excellent colour contrast with a brightly coloured racing car. A bright banner or advertisement, on the other hand, will produce a streak of colour across the film. Panned shots are easier to do when a car is travelling at a relatively slow speed—perhaps when braking for a hairpin bend. After extensive practice you may be able to take some shots at 1/60 or even 1/30 second, depending on the focal length of lens used, but be prepared to waste a lot of film at these speeds.

Producing more unusual views of the sport involves taking risks as to how many of the shots will produce a desirable effect. However, amateurs are often at an advantage in that they can afford to experiment with their approach, while most professionals are under pressure to produce a faithful and comprehensive record of the race.

Another way of giving an impression of movement is to use a repeater attachment. These leave a third of the frame normal, followed by a succession of ghost images. Used with a short telephoto, say 85 mm, and timed correctly, you can produce a shot in which the front of the car is sharp up to the driver's cockpit but with the rear section repeated right to the edge of the frame. They are particularly useful to add impact to a picture of a car when it is travelling at a slow speed. Remember however, that all devices like this should be used with restraint as they can easily become tedious if used frequently.

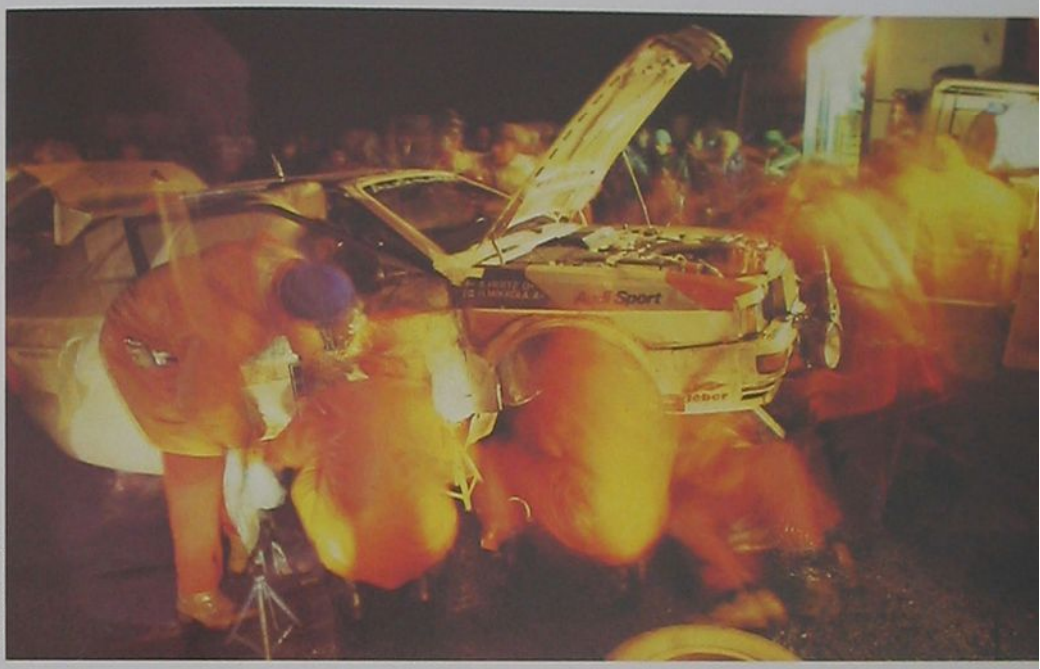
David Winter

one of the front wheels, for example, you will get an interesting composition that will also include the bright paintwork and the driver. If you have an ultra-wide angle or a fisheye lens you should also try asking the driver's permission for a close shot of him at the wheel of his car. If it is a saloon or GT car you may be able to take an unusual shot from floor level.

Modern racing drivers tend to look more like astronauts than motorists and this aspect might be worth exploring. A shot of the driver's microphone lead trailing from his helmet to the headphones of his team manager, will, for instance, underline the high level of technology involved as well as the isolation of the driver's world. A similar effect is created by using a telephoto lens to focus on the driver's eyes staring out of the aperture of his helmet. Colourful helmets, fireproof gloves, suits and shoes may all make interesting details for close-up shots.

A zoom lens can also be used to bring dynamic qualities to your pictures. Try operating the zoom control during a relatively long exposure to produce an explosion of movement and colour as a car or group of cars heads towards you. A shutter speed of anything from 1/4 to 1/30 second will give this effect—any slight camera shake will not be noticed. This will mean using a very small aperture, and on brighter days, may mean that you have to fit a neutral density filter to reduce the amount of light reaching the film. Most people prefer to zoom from the shorter focal length to the longer, but it can also be done the other way around with success.

Zooming during exposure can also be a worthwhile technique to try simultaneously with a pan shot. This takes a degree of coordination but the combined effects can produce unusual and dynamic impressions of speed.



Malcolm Bryan

Another way of adopting a creative approach to motor sport is to concentrate on relating the sport itself to the surroundings. This can mean framing a shot to include markings on the track, the crowds, track officials or a group of trees in the foreground while the race goes on in the background. Experiment by making one or the other, or both, in focus. Natural elements can also be used to advantage. For instance, the way a long telephoto lens emphasizes a layer of haze on a track can be exploited to produce a shimmering long shot of the racing cars bunched together in the distance. A downpour of rain will also have a big effect on the images with water straking from the special 'wet' tyres, and unusual reflections appearing on the shiny surfaces of the circuit. Whatever the conditions, exploit them so they work for you rather than against you. With rallying this might mean utilizing the mud or dust being thrown about, or in GT racing using long long exposures at night to record the trails of the car lights.

While the dynamic aspects of motor racing are what the sport is all about, there are also numerous opportunities for finding static subjects that also give an insight into the sport and into the atmosphere that is generated.

Unfortunately the opportunities for non-professionals to gain close access to the cars and drivers are limited at major events. If the pits are opened to the public for a brief period, you are likely to find that the drivers are safely hidden away in their motor homes, leaving the mechanics to cover up the cars and to keep them out of the reach of souvenir hunters. Once again, the best opportunities are to be found at less popular events when drivers and cars are freely accessible in the paddock—many prospective champions are happy to have their photographs taken at the early stages of their careers. At many events it is often possible to get a view of the activities in the pits during qualifying or practice. Alternatively, you may be able to shoot a few portraits of drivers in their cars while they wait in the collecting area before going out to practise.

Problems of access aside, there are many different ways of photographing drivers and their cars. Remember that if you want to isolate them from the surroundings you can use a wide aperture to render the background a blur. A high viewpoint looking down on a driver cramped into his cockpit can be very effective, but you might also want to try fitting a wide angle lens using a low viewpoint to shoot from the front or the rear of the car. By framing a shot around

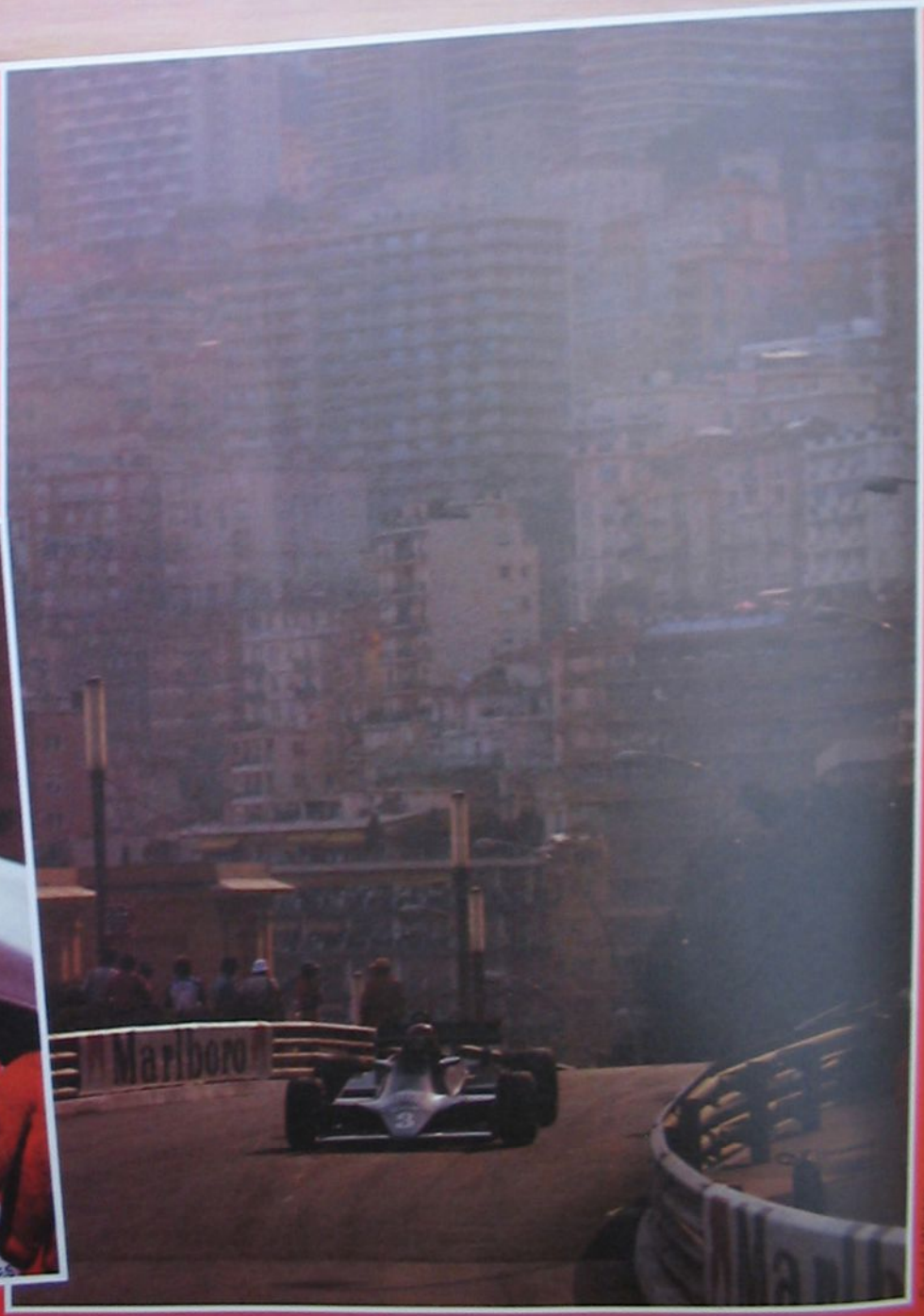
Racing cars of all types offer almost endless scope for photography. The wind cheating aerodynamic lines of the bodywork, the bright colours, the fat tyres, the complexities of the engine and suspension all provide ideal subjects for graphic compositions, or at closer range for colourful abstracts.

If you are lucky enough to have access to the pits, look around for objects around which to frame the whole scene—perhaps you could view through a spare wheel or tyre, or use the reflection in the mirror of one of the cars. From the pits you can also photograph excellent portraits—flustered mechanics, anxious drivers and team managers. One shot that offers great potential is a view of a car being refuelled, where the swirling vapours of the petrol create a haze above the car. You can even turn right round to the crowds and get some good portraits, or group shots of enthusiastic spectators in the grandstands all looking towards you.

Nigel Snowdon

Repeated image *Fitting a repeater attachment to an 85 mm lens can produce a striking sense of speed.* **In the wet** *(top right) Bad weather, particularly rain, can add drama to your shots—here, the spray makes an exciting feature of the image.* **Portrait** *(below) You can pick out details with a telephoto—this shot of Niki Lauda gains impact from very tight framing.* **Monaco** *(below right) Deliberately using the vertical format to keep the subject small and low in the frame can give your shots context.* **Champagne** *Look for candids on the winner's rostrum*

David Wintle



David Wintle

Jerry Young

Understanding...

Focusing screens

Unlike the simple ground glass screens of early cameras, the focusing screen of a modern SLR incorporates many focusing aids such as split image focusers and all manner of special surfaces

The focusing screen of the modern reflex camera seems to be a very simple component, but it has a vital role to play—without it, the camera could not be focused. And aids to focusing and the need for a bright, clear images mean that the focusing screen in an SLR can actually be quite complex.

In reflex cameras, focusing depends upon seeing the image formed by the camera lens clearly, and it is this image that the focusing screen shows. Although you can see through the lens clearly, it is not usually possible to see the image unless a surface is placed at the point of focus. Without such a surface, the image is a barely visible *aerial image*. If you concentrate, you can sometimes just see this image through the open back of the camera (with the shutter held open) around the edge of a knife held at the film plane. But it is almost impossible to focus. It is also impossible to see all the picture format at once.

Dave King

SLR focusing screens *incorporate tiny prisms*

Basic screen

It would be possible, in theory, to focus the image on an opaque screen like a projection screen, but this would be totally impractical in a camera. Camera construction is much easier if you can see 'through' the screen. A clear glass screen would not register the image, so one side of the glass is finely ground to make it translucent. The grinding is done using fine abrasives which form millions of small irregular prisms on the surface. These have the effect of diffusing the light through the screen.

A very finely ground surface gives a dim image but allows critical focusing of fine detail. A coarse surface gives a brighter image but loss of fine detail. Newer screens use laser treated surfaces to produce smoother prism surfaces and brighter images.

The ground side of the screen is accurately positioned either in the actual focal plane of the camera (as on large format types) or at an *equivalent focal plane* (with reflex types) where the distance from the lens to the screen via the mirror is the same as the distance from the lens to the film.

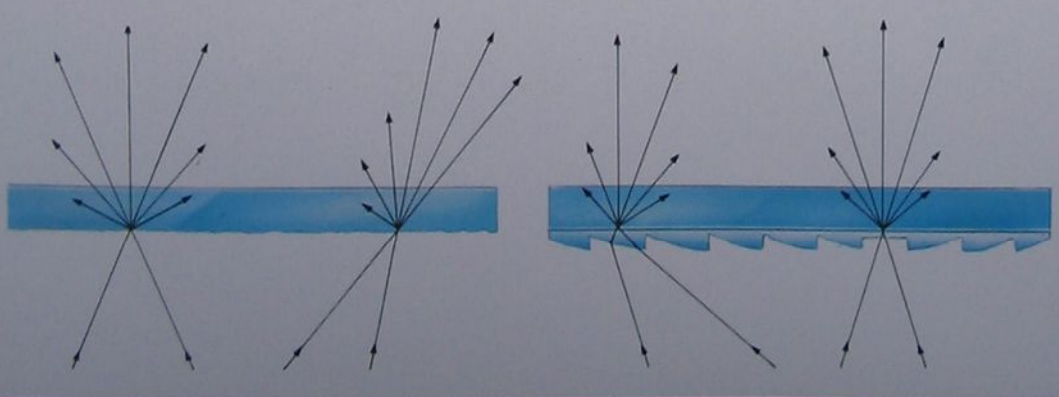
This basic screen is still sometimes used on large format cameras, though it has a number of drawbacks. The scattering of light means that the image is very dim, especially when compared with the aerial image. In addition, the edges are darker than the centre, giving a pronounced *hotspot*.

This happens because light near the edge of the frame is hitting the screen at an angle, so much of the emerging light is directed away from the eye. This is noticeable with wide angle lenses.

A simple cure is to have the ground surface as the flat side of a plano-convex shaped lens with the surface facing the viewer. This has the effect of bending the light rays coming from the screen inwards towards the eye, giving a more even appearance.

While such lenses are still used in some 35 mm SLRs, the necessary size and weight for large format cameras make this system inconvenient. Fortunately there is an almost flat equivalent in the form of the *Fresnel* lens which is often made of moulded transparent plastic. This consists of concentric circular ridges which act like lenses to bend the light inwards. The depth of all the ridges is the same, though the curvature changes so that the ridges near the edge of the frame bend the light more than those in the centre. The rings are so small that they are hard to detect.

How a Fresnel screen works



Advertising Arts

Fresnel *With a normal screen (left) light is lost at the edge, but with a Fresnel (right), edges bend the light and keep the image even*

Focusing aids

As a further assistance to focusing, many screens incorporate aids in the form of *split image rangefinders* and *microprism* arrays. These are 'passive' devices in that they have no moving parts and rely for their effect on the deviation of light by small thin prisms.

The basic split image rangefinder consists of two wedge-shaped prisms placed together but sloping in opposite directions. These are set into the focusing surface of the screen. When the image is in focus the apex of the cone of light coming from the lens coincides with the focusing surface. This light passes undeviated through the prisms. When the image is out of focus the apex of the cone falls behind or in front of the screen. The section of the cone falling on the prisms is split and displaced in opposite directions thereby splitting the image. These displacements need not be very large to be detected by the eye. The human visual system is very sensitive to even minute displacements—a property called *vernier accuracy*—and so such devices are very effective.

Microprisms are a logical extension of this split image principle and consist of a very large number of very small pyramid shaped prisms. The pyramids are usually three or four sided and have base lengths anywhere between 0.01 mm (for movie cameras) and 0.1 mm. They cannot be resolved by the eye due to their size, but when the image is out of focus the effect is one of a 'shimmering' image. This is caused by multiple splitting of the image. When the image is focused the microprism clears and gives an undistorted view.

As these parts of the screen do not have any ground surfaces the image seen through them is an aerial one. The result is that the image is bright and nearly always in focus. This makes them useful for focusing wide angle lenses which are difficult to focus normally due to their large depth of field. The bright image also makes them useful in low light.

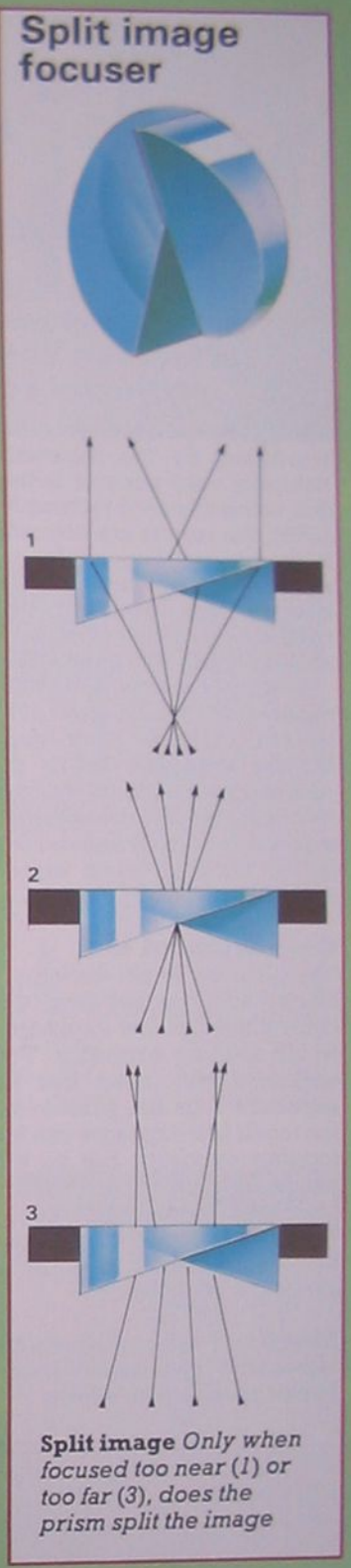
The accuracy of split image rangefinders and microprisms depends greatly on the aperture in use, so large aperture lenses give greater accuracy. With apertures of around *f*/5.6 or smaller the exit pupil of the lens and viewfinder system is very small. So if the eye is not located in just the right place the light from one of the rangefinder halves, or from parts of the microprism, may not reach the eye and so half of the rangefinder appears black. With very small apertures it can be impossible to place the eye in such a way as to see all the images from the prisms.

To help overcome this, cameras with interchangeable screens often have special microprism screens available suitable for lenses such as wide angles or telephotos.

Normal screen *Fine ground screens, sacrifice brightness for detail*

Acute matte *Although coarser, these regular prisms are clear and bright*

courtesy of Minolta



Split image *Only when focused too near (1) or too far (3), does the prism split the image*

Advertising Arts

Advanced Sabattier effects

You can eliminate much of the uncertainty associated with 'solarization' effects in colour by making a few simple re-exposure tests. Even more colourful results can be obtained using 'solarized' printers or masks

The glowing, weirdly coloured images produced by the Sabattier effect are naturally very popular in the darkroom. But, using standard techniques (see page 1358), the results are unpredictable, and it is almost impossible to repeat a successful print exactly. However, by either refining your technique or using masks to 'solarize' indirectly, you can achieve much more control.

The refinements to technique can be made in three main areas of the process: in the original print exposure, the fogging exposure and in printing. For print exposure and the fogging exposure you can use the *chequerboard test* to assess exposure times and the necessary colour filtration much more accurately than with the basic method.

Chequerboard test

The difficulty in producing a satisfactory image with the Sabattier effect lies in controlling the first exposure in relation to the fogging exposure. Too little first exposure can mean that the fogging exposure fogs the print to black, while too much first exposure can mean that the fogging exposure has no effect on the image. Furthermore, fogging exposure time must be carefully controlled, and you must choose the precise point in the development time at which this exposure takes place.

Another factor which makes Sabattier colour printing somewhat unpredictable is the fact that the partly formed positive dye image from the first exposure may filter the white light of the second exposure. It is very difficult to foresee the results of this effect.

The chequerboard test makes both these factors easier to control. To carry out the test, first make a test strip for colour balance as for normal colour printing. Once you have determined the right filtration, expose a whole sheet of colour paper in five second steps from 5 to 30 seconds, moving from left to right. Place the unprocessed sheet in a light safe, and repeat the process with two more sheets.

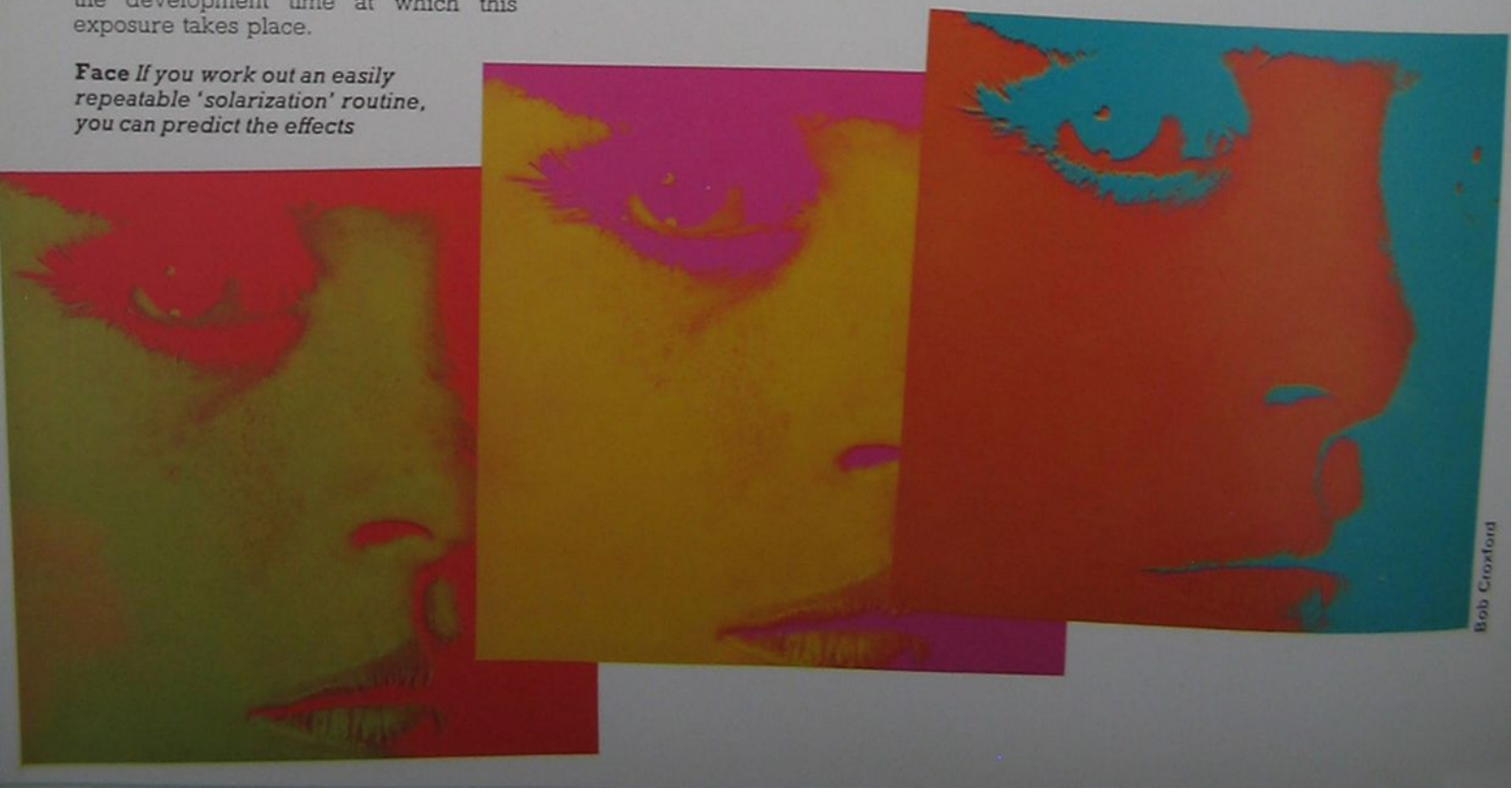
Remove your negative from the negative carrier, turn on the light, and dial in the filtration to print a red colour from a black and white negative (see page 858) at 20Y + 10M. Set the enlarger lens to *f*/11, and, in darkness, take a strip of colour paper and expose it in five second steps from top to bottom—a reasonable range would be 5 to 50 seconds. Process the test strip for half the standard processing time—1¾ minutes in the case of Ektaprint 2.

The test strip should show a pale red at the highlight end, bright pure red in the mid tones and a reddish black at the heavy end. If it does not, adjust your enlarger lens aperture until you obtain this range, otherwise the range of fogging exposure effects will be limited to one end or the other of the scale. Make test strips in the same way for green (80Y + 60M) and for blue (100Y + 45M). Assess these, ensuring that they give you a sufficient range of density.

Set your enlarger to red filtration once more, and switch off the darkroom light. Take one of your unprocessed colour prints from the light safe, and process it for half the development time. Transfer the print to a water rinse at the correct process temperature, and from there to a dish of warm, still water—pre-positioned on the enlarger baseboard. Give the print the red fogging exposure as for the test strip, and finish processing as described. Repeat the process in exactly the same way for the other two prints, with blue and with green filtration for the fogging exposure.

You can also make tests in the same way for cyan, yellow and magenta re-exposures, using the following filter combinations: cyan 100Y + 85M; yellow 20Y + 45M; magenta 80Y + 20M. You may have to adjust these filter figures to get just the colour you like.

Face *If you work out an easily repeatable 'solarization' routine, you can predict the effects*



Bob Croxford

The prints from all of these tests should give a coloured chequerboard effect, showing how any combination of first and fogging exposures will look. This should give a sufficiently wide range of densities for you to choose the effect you want. Make a note of the first exposure and fogging exposure you require, and use these to make your final solarized print as described below.

Printing procedure

When printing, you must keep the solutions at the correct temperature all the time, and the agitation must be consistent—you should also wear rubber gloves whenever you handle wet prints. Practise moving the colour paper from the developing dish to a quick rinse of water at the processing temperature, and from there into a dark coloured or black dish of still water on the enlarger baseboard, ready for the fogging exposure. From there you return it to the developer to complete the remaining processing stages.

Once you have made all your tests and determined filtration and exposure, make the exposure from the colour negative on to the printing paper. Put the print into the light safe, and turn on the darkroom lights. Remove your negative and re-set filtration for the fogging exposure. Before you turn off the lights, check on the whereabouts of all dishes, and wear rubber gloves.

Turn off the lights, set the print timer and take the print from the light safe. After the correct development time, remove the print and give it a quick water rinse—a few seconds at the correct process temperature—and transfer it to the dark dish on the enlarger baseboard. It is a good idea to lay a towel under this dish to absorb any drops which may fall from the print.

Remove your gloves, ensure that your hands are dry, and give the fogging exposure. Put on your gloves once more, transfer the dish back to the wet area of the darkroom, and put the print back into the developer for the remaining development time—in the case of Ektaprint, this is 1¾ minutes.

Controlled effects on film

You can adopt the chequerboard technique for making controlled solarizations on film instead of paper. But you will have to adopt dish processing techniques (see page 1360). It is best to work with large-size copies of your originals, using sheet film of at least 9 × 12 cm. Use the same test and re-exposure methods.

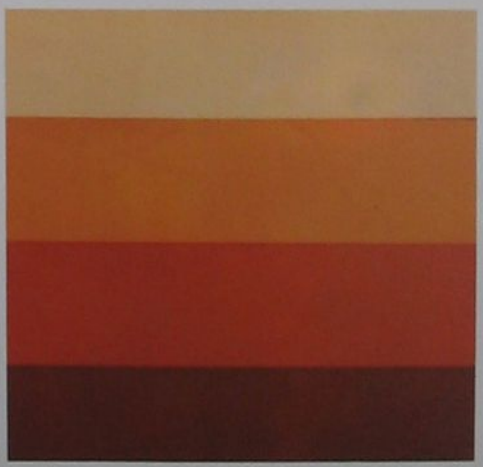
As the Sabattier effect is so difficult to control, and involves so many variables, it is quite possible that your first few prints may not show the effects you want—even a small mistake in the timing can have an unexpected result. Repeat the process until you achieve the desired density and colour balance. If you still find you cannot achieve controlled results, you can try 'solarizing' indirectly.

Controlled solarization

Original image colour	Re-exposure filter	Predicted result
Grey	20Y	blue
Grey	20M	green
Grey	20C	red
Grey	20M + 20C	yellow
Grey	20Y + 20C	magenta
Grey	20Y + 20M	cyan
Blue or cyan	20M	yellow
Blue or cyan	20Y	magenta
Blue or cyan	white light	red/yellow
Red or magenta	20C	yellow
Red or magenta	20Y	cyan
Red or magenta	white light	cyan/green
Yellow	20C	red
Yellow	20M	green
Yellow	white light	orange

FIRST EXPOSURE

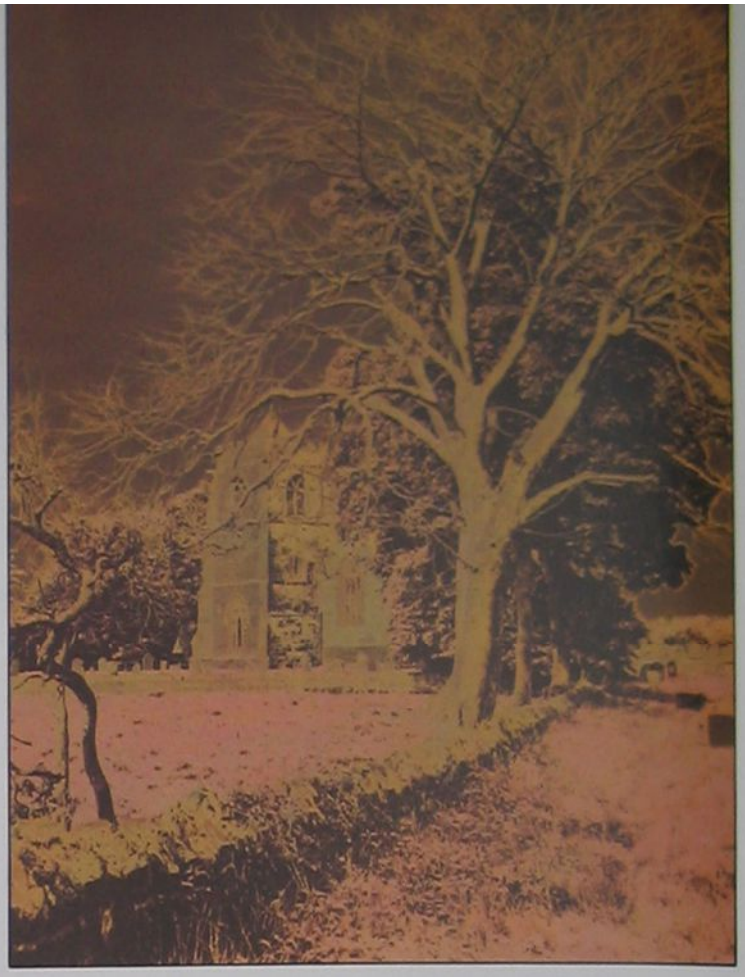
FOGGING EXPOSURE



Tim Stephens

To make a chequerboard test for controlled solarizations, start with a conventional test print covering a range of exposures (above right). Develop for half the normal time, rinse the print and then re-expose it to coloured light, in steps along a path at right angles to the previous exposures (above). The ruled lines on this print indicate the chequerboard pattern. Choose whichever combination of original and second exposures gives an effect you like and make a final print (lower right). The colour used for re-exposure, shown in test strip form (lower left), is changed to a much pinker red on the final print—because of image formation in the partly developed print.

Using negative-positive colour printing paper and the suggested printing filters, you can expect the results shown in the table (above) when making re-exposures. However, you should use these filters only as a starting point for your tests.



Churchyard *A sandwich of a black and white solarized copy negative and the original colour negative printed on Cibachrome (left) and on neg-pos paper (right)*

Making masks

By using masks, you can exercise much more control over Sabattier effects. From your transparency original, you start by making a Sabattier black and white film image, which is then enlarged on to lith film to make three identical positives and three negatives. These can be used in various combinations to print on colour reversal paper, with filtration, to produce many controlled solarization effects in any colour.

To make a black and white Sabattier film, use a fine grain film such as Kodak Fine Grain Positive type 5302. First contact print the transparency, then fog the film to white light during processing, as described on page 1360. Register punch three sheets of lith film, and enlarge the Sabattier image on to them, to make three identical lith positives. Contact print these on to three more lith sheets to make three lith negatives.

Washing line *A Mackie line solarized b & w negative was produced from a colour negative and printed in blue on neg-pos paper (left) and combined with the original colour neg to produce the orange image on Cibachrome (right)*

Retouching masks

If you want to solarize certain areas of the image in preference to others, in certain colours, you can retouch the lith masks accordingly. For example, if you want selected areas solarized in red, black out all areas on one of the lith positives which you do not want to print red. This mask is now the *red printer*, and by exposing your paper under it with red filtration in the enlarger, you will solarize the required parts of the image in red.

You can retouch the other two masks

to make green and blue printers, and by carefully positioning the retouched areas you can combine colours. The principle is that of additive printing—by overlapping colours, you can create any combination of hues.

When you retouch, lay your positives side by side on a lightbox, so that you can clearly see how the relationships between the different areas of colour build up—certain areas might overlap, producing complementaries, while others might look better with pure primary colours. It is easier, and often more effective, to keep effects simple.

Remember to retouch your masks with black liquid, or you will print unwanted colours. Label your red, blue and green positives R1, B1 and G1 respectively, and the negatives R2, B2 and G2, for easy identification.

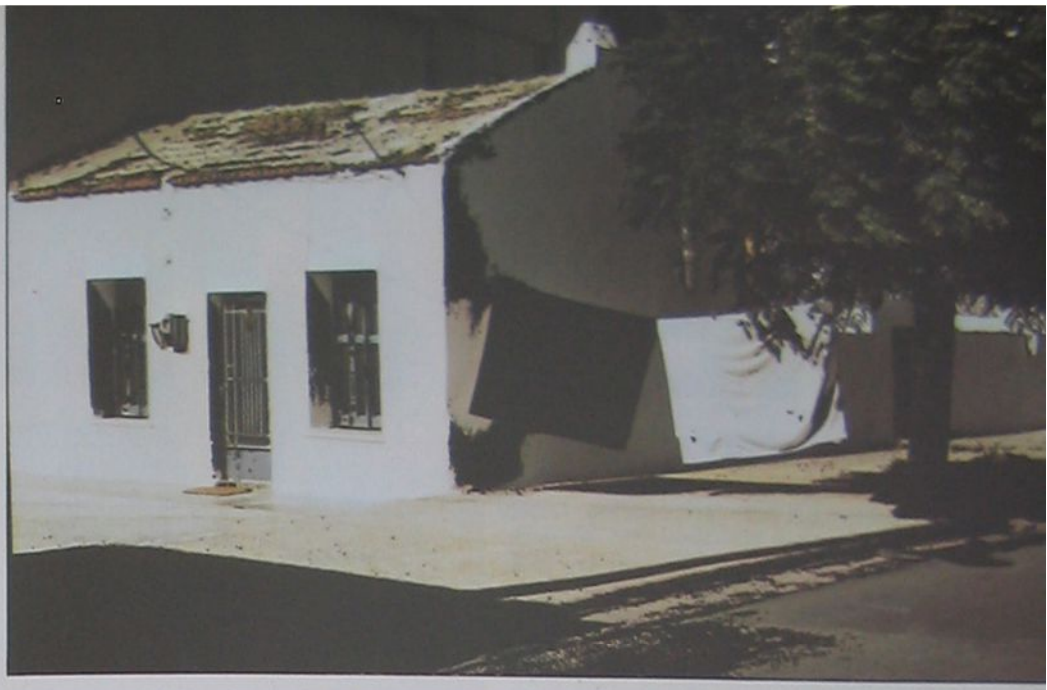
Printing with masks

To make a controlled solarized print, set your enlarger to white light and with the negative in the negative carrier, line up the image with mask R1 registered on the easel. Punch a sheet of paper and set it on the pin bar.

Expose the paper, using a Kodak No 25 filter or equivalent, for 10 seconds at *f*/8, and make similar exposures through masks B1 and G1, using Kodak 47B and 58 filters respectively, or equivalent. Follow these with any exposures you like—for example, you might print R2 with filter 47B, B2 with filter 58, and G2 with filter 25.

The resulting print would show white Mackie lines, because these have been exposed to light of all three colours, equivalent to white light. Areas which have received the R2 exposure will show blue flat colour, while those from the B2 exposure will be green, and G2 areas red. If any areas have been exposed to two masks, these will print as complementaries—blue and green produce cyan.

Another variation would be to omit one of the exposures through negative masks—the Mackie lines would then print as a complementary colour, not white. Once you have mastered the basic techniques, you can predict how colours will print, and produce a great variety of controlled colour solarizations. You could even adapt this technique for use in neg–pos colour printing.



Tim Stephens

Using masks
By using a range of solarized masks (right) and reversal print material such as Cibachrome, intense re-exposure colours are possible. A straight print re-exposed to one type of mask gives subtle image build up and a lot of black (top right) But by printing the slide with one type of mask for each different colour, striking and really colourful results can be obtained (above)

Robinson/Brown

Bringing back VIETNAM

Photographers and journalists documented the war in Vietnam in greater detail than any other conflict ever. Their pictures now form an amazing archive

Larry Burrows/LIFE © Time Inc. 1966/Colorific

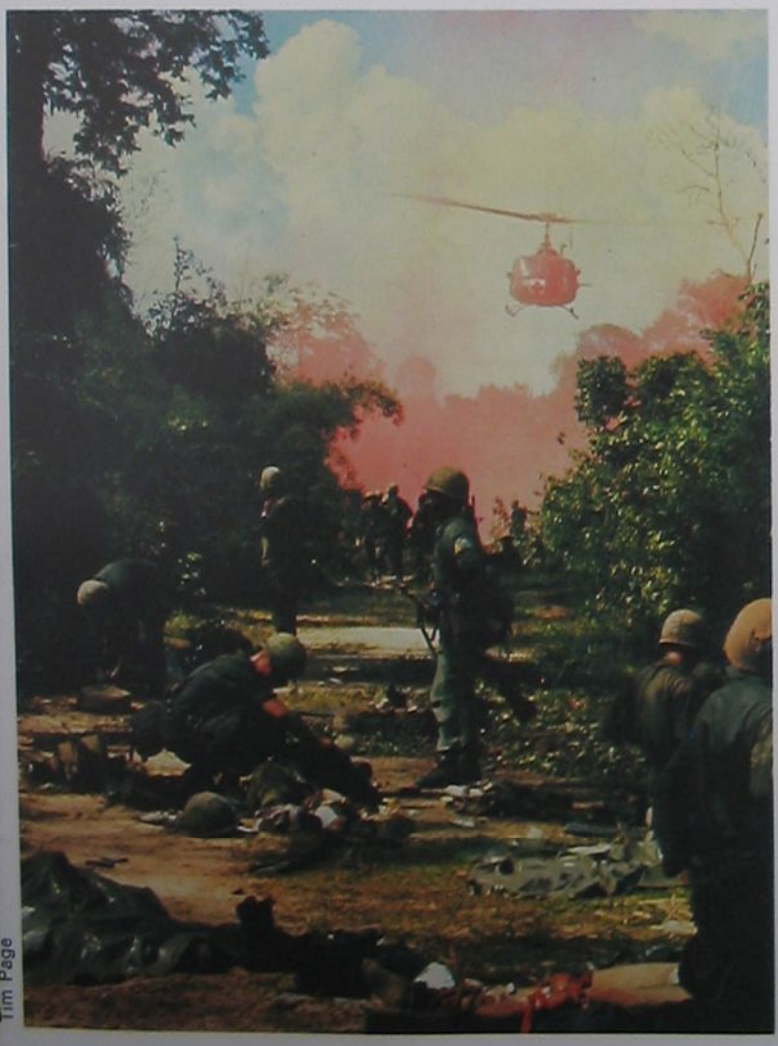
Photographers have been carrying their cameras into war since the Crimean conflict over 130 years ago, but no war has been as extensively documented as that in Vietnam. Unlike previous hostilities, the civil war in Vietnam was very much a media event. This was largely because of the wholesale involvement of the United States. There was a vast, literate public 'back home' to be kept informed of the war's progress. This audience expected sophisticated, detailed and up-to-date information, and the media responded to and fed these expectations.

At one point in 1968 there were 637 accredited correspondents and photojournalists from all over the world covering the war. Not only was the coverage extremely wide, it was also immediate. Indeed, Vietnam has been referred to as a 'television war' with newsreel footage and still photographs being screened in homes across the world within hours of their being shot on location in Vietnam.

With modern transport and the active support of the American military machine, the film crews, journalists and photographers could reach the combat zone easily. They flew into South Vietnam's capital, Saigon, and then went on by plane, helicopter or jeep to the front line. It is a rather bizarre concept, but photographers could, in effect, 'commute to work' daily, shooting their pictures on the battlefield and returning to their Saigon hotels at night with their

Larry Burrows/LIFE © Time Inc. 1966/Colorific

Compassion *A wounded GI reaches out in obvious sympathy to a stricken comrade. This picture was taken at a first aid post during Operation Prairie in 1966*



Tim Page

Recovery *Four marines rescue the body of a fifth as their company comes under fire. Burrows' fellow photographer Catherine Leroy appears in the right of the picture*

Ambush *In all, some 19 soldiers were killed and 35 were wounded in a 5 second ambush on this Company of the 173rd Airborne Brigade. They were on an old rubber road in the 'Iron Triangle'*

pictures safely on the wire service or air freighted to the USA or Europe.

But it was not all easy. Just like the GIs out there fighting, the photographers could get killed or maimed and become just another accident statistic. Those who did live to tell the tale are still intensely affected by the experience many years later. Don McCullin, has spent over 15 years covering wars, for the London *Sunday Times* and other publications, and says, 'People sometimes fail to understand how much the photographer himself is emotionally disturbed by what he photographs. They think that all photographers are just ruthless and relentless. But some picture of mine that they saw a couple of years ago has probably stopped hurting them —it is still hurting me.'

Obviously the motivations of journalists and photographers working in Vietnam varied, but for many of the generation who grew up after World War II, Vietnam provided a real life version of a children's adventure story. It attracted a new breed of what have been called 'protojournalists'. They headed for Vietnam in the mid-1960s and cultivated a kind of devil-may-care attitude to the war.

One such protojournalist was Tim Page, who freelanced and worked for *Life* magazine in Vietnam. He was wounded several times in 1966/7 before being seriously injured in 1969. He was later turned into a kind of legendary character by the media. He features in Michael Herr's book *Dispatches* and in the film *Apocalypse Now* in which Dennis Hopper plays a character supposedly based on Page.

Undoubtedly, Page's attraction to the glamour of the war led him to some extremely dangerous situations, but his hard news pictures tend to be largely functional with only the occasional memorable image. Like many others, he thrived on the excitement of war and the closeness to death. When asked to write a book that would take the glamour out of war, he is said to have replied, 'Take the glamour out of war. How the hell can you do that?. . . . Its like trying to take the glamour out of sex.'

Another view of the role of the photographer at war comes from Don McCullin who says, 'In a war I'm up with the front-line soldiers. I take what they get, sleep where they do, I help them when they're in trouble . . . . I'm taking photographs, but I always behave like a person first and a photographer second.'

Out on a battlefield the modern-day photojournalist is well equipped to deal with photographic eventualities. Many carry up to four or five camera bodies, a wide range of lenses, motor drive units and light meters, as well as dozens of rolls of film—both colour and black and white. They usually use 35 mm equipment, simply because it is lighter and easier to carry.

One change Vietnam did see at the front line was the increasing involvement of women photographers. Two of the best known were Catherine Leroy

and Christine Spengler. Leroy says that the soldiers rarely objected to a woman being present. She began photographing the war in 1966, working as a 'stringer', or freelance for Associated Press, but was badly wounded in 1967.

From the beginning of the war, the power of the press was recognized and US military officials readily assisted photojournalists in their work. And during the course of the war people began to appreciate just how much images could, and did, influence public opinion. This influence was not always that intended by either the photographer or the military authorities. Sometimes information or pictures which were originally intended to support American involvement swayed public opinion in the opposite direction.

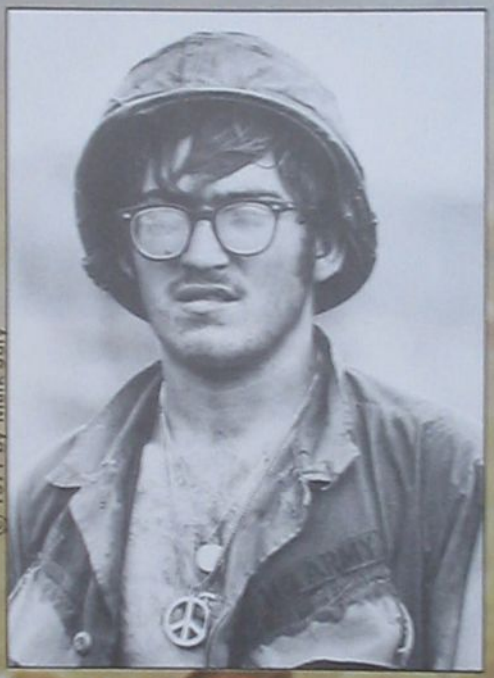
Many pictures were not published at the time, but were filed away by photo libraries and other organisations. Now, almost a decade later, they represent an amazing archive, a documentary record of a particularly grim period in the history of South-East Asia and the USA.

Many news images were so memorable that they outlived their immediate context. One which stands out was taken in 1972 by Nguyen Kong (Nick) Ut, who was working for Associated Press. It shows South Vietnamese children running from the scene of a misdirected napalm-bomb attack by a South Vietnamese Skyraider at Trang Bank, (see page 488). One of the children has escaped death by ripping off her flaming clothes. It is a powerful and extremely memorable image, evoking a sympathetic response by its reminder of the many innocent victims of wars like Vietnam.

Another particularly striking image was a picture taken during the Tet

Philip Jones Griffiths/Magnum

A brother's grief *Over 85 per cent of the population of this town were destroyed in an American bombardment in October 1968*



© 1971 by Mark Jury

Peace medallion *Jury attempted to record telling details of the daily life of combat forces, including non regulation fashions and decorations*

Larry Burrows/LIFE © Time Inc.

Larry Burrows/LIFE © Time Inc. 1966/Colorific

'Magic dragon' *Mid air shot of a plane with mounted guns. Burrows took many pictures from the air and was later killed in a helicopter crash*

Ambush *South Vietnamese soldiers, spurred on by Americans, retaliate after being ambushed. Photographer Burrows was with the patrol at the time*

offensive in 1968 by Eddie Adams, (see page 488). It shows Brigadier Nguyen Ngoc Loan, police chief of Saigon, summarily excuting a Vietcong suspect in the street. Adams, who was also working for the Associated Press, says, 'I made the picture by instinct. Any idiot could have taken it.' He had no warning that Brigadier Loan was about to shoot the prisoner. 'As his hand came up with the revolver, so did my camera, but I still didn't expect him to shoot.'

A film crew present at this execution also recorded the event and the effect of seeing this footage later on television was considerable. But it is Adam's picture which froze the moment before death, and its stillness and simplicity gave the public a chance to actually 'see' the gunshot. The picture was syndicated worldwide and some would say it changed the course of the war. There can be no doubt that this picture provided powerful ammunition for anti-

Philip Jones Griffiths/Magnum

Philip Jones Griffiths/Magnum

Faceless napalm victim *The absolute anonymity of this image gives it a universal application and impact. It was taken in 1967*

Prisoners *Hatred, misery and defeat as South Vietnamese troopers herd four roped Vietcong prisoners aboard a boat in the Mekong delta. 1971*

Larry Burrows/LIFE © Time Inc. 1966/Colorific

Departure *American troops leaving Cambodia late in June 1970*

war campaigners in America.

But it was not until 1969 when news emerged of the massacre of Vietnamese civilians at My Lai in 1968 that large numbers of the American public became aware that US involvement in Vietnam needed to be re-examined. Even then, My Lai was treated as an aberration or an exception to the rule. In fact killings such as this were clearly a fairly common practice. Even when photographic proof appeared from Ron Haeberle, a US Army photographer present at the massacre, the media were still cautious.

Having witnessed similar atrocities, photographer Philip Jones-Griffiths commented, 'If I had gone back to Saigon and into one of the agencies and had said ''I've got a story about Americans killing Vietnamese civilians'', they would have said ''so what's new''. It was horrible, but certainly not exceptional, and it just wasn't news.'

Jones-Griffiths's book *Vietnam Inc.* was published in 1971 and stands alone as probably the most successful and useful photographic publication to come out of the Vietnam war. Its strength lies in its coherent use of informative text, linked to a clear structure, reinforced with powerful photographs. Jones-Griffiths was one of the few photo-journalists to concentrate on portraying the effects of the war on Vietnamese civilians. He had great difficulty in finding an outlet for his work in the US. 'I was told time after time that my photographs were too harrowing for the American market.'

Jones-Griffiths' book resulted from his discovery that most of his published pictures were those that toed the official Washington line. He realized that if he wanted the main body of his work to be seen he would have to publish them himself. 'In the end I had to write the thing, I had to do the layout, I had to do everything except sell it.'

Jones-Griffiths saw the task of the photographer very clearly. 'Your job is to record it for all history. You cannot feel involved, but you have to steel yourself and do your job, take the photographs. That's what you're there

Don McCullin/Magnum Distribution

Ronald Haeberle/LIFE © Time Inc. 1969/Colorific

My Lai massacre *The bodies of Vietnamese civilians left in the road after this incident which later received so much publicity, both in America and abroad. Over 120 civilians, mostly women and children, were executed on 16 May 1968 by officers and men of C Company, 1st Battalion, 20th Infantry, 11th Brigade*

Exhaustion *Resignation shows clearly in the tired eyes of this soldier*

for. It's no use crying. You can't focus with tears in your eyes. It's better to do the breaking down later in the darkroom.'

In the years since Vietnam quite a number of photographic books have been published. Two other books which were published in 1971 were Don McCullin's book *The Destruction Business* and Mark Jury's *The Vietnam Photo Book*.

In *The Destruction Business* McCullin's Vietnam pictures were included among many other images of tragedy, suffering, violence and death. The book was later revamped in 1972 into a more glossy volume *Is Anyone Taking Any Notice?*

Jury's book, on the other hand, was exclusively about Vietnam and attempted to deal with this war in greater depth. It is a reminder that a whole generation of American youth was growing up while doing service in Vietnam. As one US correspondent put it, 'I think Vietnam was what we had instead of happy childhoods.' We see the hippy generation at war while the 'flower power' scene was taking off in America. Here is the almost unacceptable face of American GIs—the new style frontiersmen.

Jury locates this generation firmly in the context of the ground war—he shows us the fire-bases and their crews, the vast administration, the celebrity visits, the street life and the artificial limb centres. He does not dwell on the familiar hero/victim theme. He opts instead for attention to detail that is hard to find elsewhere—the graffiti, the signs, the body decoration, the visiting cards left on dead bodies and the non-regulation fashions.

Another photographer, Larry Burrows, working on assignment for *Life* magazine, started out believing in the war. At first he produced many powerful, almost celebratory, pictures showing the might of the American forces. But towards the end, he began to question both the American presence and his own way of representing the war.

Most photographic records of the Vietnam war were made from the American lines. Very few correspondents or photographers actually visited North Vietnam. But in 1965 the well-known British journalist James Cameron, photographer Romano Cagnoni and film-maker Malcolm Aird were allowed visas to visit the North. They were treated with suspicion but allowed to operate for a while, before suddenly being asked to leave.

Still fewer journalists reported from the Vietcong side. An exception was the Australian, Wilfred Burchett who started reporting on the war from North Vietnam in 1963, and continued to do so for the rest of the war. As the nature of the Vietnam war changed, so reporting and photographic coverage gradually altered in approach—particularly after 1969. This was the time when ground troops were starting to be withdrawn although the war from the air was still being waged just as fiercely.

Don McCullin/Magnum Distribution

Personal effects *A fallen North Vietnamese soldier's possessions, rifled by passing GIs*

However, photographers and reporters were not given access to the aircraft that went out on the bombing raids over North Vietnam, Laos and Cambodia during the late 1960s and early 1970s.

In the 1970s, this area of South East Asia began slowly to slip from view in the media. It became a forgotten war until very recently when US veterans became more active and vocal and started to publish their own accounts of the war. These versions of events and previously unpublished photographs are still having a powerful effect over a decade later.

In his book *Dispatches*, published in 1972, Michael Herr tells us about some of the images that GI's themselves would have been carrying. They are another part of the 'unofficial' history of the war. 'There were hundreds of these albums in Vietnam, thousands, and they all seemed to contain the same pictures . . . . the obligatory Zippo lighter shot; the severed head shot, the head often resting on the chest of the dead man or being held by a smiling Marine; or a lot of heads arranged in a row—a Marine holding an ear, or two ears, or a necklace made of ears. Such private images are not usable in the press. They represent a completely different document of the war; there is no one objective account.'

Recently there has been a renewed interest in the Vietnam war as parallels are drawn with violent events elsewhere. Vietnam has also been turned into a highly saleable commodity. Endless books have been written and Hollywood has started its own cinematic reappraisal of this now 'safe' period in American history. From this vast output Michael Herr's book *Dispatches* and the film *Apocalypse Now* stand out. They give some idea of the scale, technology and pointlessness of this war—a gargantuan spectacle which both photographers and journalists were vainly attempting to document and render comprehensible.

What went wrong?

By the sea

Three attractive pictures taken by the sea in winter—but there are many compositional faults, as Sergio Dorantes points out

This picture presents the raw material for a photographer to achieve a good result. But a close look at the shot reveals some basic mistakes which could easily have been avoided. If the three elements of the picture—the vastness of the sea, the wavebreaker, and the human form—had been well placed, the result could have been an excellent picture rather than a poor one.

A major problem in the picture is the angle of view that has been chosen. It almost splits the photograph in two, giving equal prominence to the sea and the sky, and it also gives the impression that the wavebreaker is cutting through the woman's neck. The sky has been overexposed, and consequently lacks detail. Underexposure would have added detail to the sea and sky and would effectively have turned the woman into a silhouette, a result which works well when shooting against the light. In addition, there is flare in the lower right-hand corner which is caused by shooting right into the sun and which could have been eliminated with a change in viewing angle.

This photograph has some good points, such as interest, emotion, good exposure and acceptable composition, all of which the photographer should always strive to accomplish in a picture. Despite these attributes, something vital to making this an outstanding photograph instead of just an acceptable one is missing. What it fails to capture in the drama of the moment—perhaps by showing the facial expressions of the people as they react to the wave breaking on the waterfront. This could have been done without disturbing the people or the exposure, either by the photographer getting physically closer to the people or by the use of a longer focal length lens. On occasions such as this, anticipation, quick reflexes, and a thorough knowledge of the equipment being used are of paramount importance.

The subtle colours and atmosphere available to the photographer in this scene could have produced an accurate interpretation of the mood of the place. In this case, placing the horizon in the middle of the picture has reduced the impact. The overall exposure is good in relation to the entire scene, but it has revealed suggestive details in the figure of the man which arouse the viewer's curiosity. One tries to discover more about the man's identity. The picture should either have been exposed so as to indicate his features, thus satisfying the viewer's curiosity, or else made to show him as just a shape. Furthermore his position, close to the edge of the frame, breaks the consistency of the composition. This is one case where the 'Golden Mean' rule could have produced a better organized composition. Something on the right is vignetting the lens and has spoiled the composition. This can be prevented, as a rule, with a quick glance around the viewfinder before the shutter is released, thus avoiding disappointment and waste of film.

PICTURES FROM TV

Most people have a source of interesting and dramatic pictures within their own homes—the TV set. And with a few simple techniques you can shoot subjects which would normally be out of your reach

When the first men landed on the moon there was only one camera set up on the lunar surface, and this was controlled exclusively by the astronauts. Yet within hours of the landing hundreds of people across the world had made their own photographic record, with their own equipment, of that historic event.

Of course, the camera used by the astronauts was a television camera, and the shots taken were transmitted back to Earth and then broadcast live, internationally. Enterprising amateurs everywhere grabbed the opportunity to take photographs from the television screen, thereby demonstrating its potential as a source of exciting and otherwise unobtainable photographic material.

However, you do not have to restrict yourself to such relatively unusual events—everyday programs hold plenty of documentary and novel material suitable for making interesting images. All you need is an eye for a 'still' and a few straightforward techniques.

No copyright law prevents you shooting *live* broadcasts, unless already copyrighted material, such as a painting, is involved. Recorded material, however, is always covered by copyright. If you are unsure what you can legally shoot, check with the broadcasting company.

Simon Atherley

The main event *Shooting the TV allows you to get pictures of people and events, here, McEnroe at Wimbledon, which might otherwise be unobtainable*

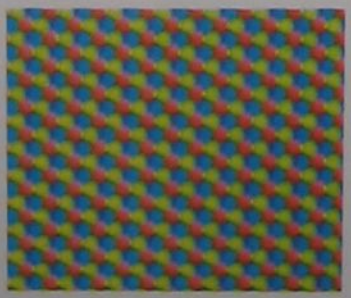
The television screen

To understand how to take the best possible pictures from the television screen, it helps to know a little about how the image is formed.

Television pictures are produced by an electron beam, generated inside the picture tube. The beam strikes the inside front surface of the tube, which is coated with spots or lines of phosphorescent material. These glow at the

Different types of television picture

Coloured bars *This screen uses red, blue and green bars in interlocking groups*



Coloured dots *Here the colours are built up by dots in triangular groups*

Coloured stripes *A few TV sets build up the image with continuous vertical stripes*

Mono stripes *Black and white sets have the simplest system with horizontal lines*

Choosing the right shutter speed

The shutter speed is the most crucial factor when shooting pictures of a TV screen. In this series of exposures the one shot at 1/15 second is most successful. The slower speeds—from 1/2 to 1/8 second—all display some degree of blurring. Although this can make the pictures interesting pictorially, they are useless as records of an event. As a television set takes 1/25 second to build up a complete picture, shutter speeds faster than this do not show a complete image. The result is a dark band across the screen. The faster the shutter speed, the less picture is visible so that, at 1/250, almost the entire screen is dark. The picture taken at 1/30 second seems to be perfect at first glance, but in fact there is a small dark band at the top which would be noticeable when the shot is projected or enlarged

1/2 second

1/4 second

1/8 second

1/15 second

1/30 second

1/60 second

1/125 second

1/250 second

Clive Helm

point where the beam strikes them, and it is these glowing spots that we see as a picture on the screen.

The beam scans rapidly across the screen, forming one line of the picture. As soon as one line has been completed, the beam whips back to the beginning again, and 'draws' the next line down. Thus the picture is built up line by line.

The beam does not build up the whole picture in a single pass, however; instead it scans every other line before returning to the top of the screen to fill in the gaps. Each pass takes 1/50 second, so for the two passes needed to make a complete picture, it takes a total of 1/25 second.

Differences in brightness are produced by changing the intensity of the electron beam. With colour television, there are triplets of phosphorescent dots which glow in each of the primary colours—blue, green or red. There are usually three electron beams as well, one for each colour. Differences in colour are created by carefully controlling the intensity of each of the three electron beams.

In most countries, there are a total of 625 lines on the screen, though a few countries work to different standards—Canada and the US for example, use only 525 lines. This system also has a slightly faster scan rate, and each picture takes 1/30 second instead of 1/25.

These technical details are important because they dictate how pictures of a television screen must be taken, and how good the quality is likely to be.

Because the picture is built up over 1/25 or 1/30 second, shutter speeds faster than this cannot be used, or only a portion of the screen image will appear in the picture. The pictures on these pages show what happens if you set your camera to the wrong shutter speed.

The number of lines that make up the image sets an upper limit on the quality that you can expect in pictures taken from the television screen. Even the best quality television picture is incapable of matching the resolution of a picture taken with a cheap 110 snapshot camera. With a 35 mm camera, the quality of the lens and the resolution of the film have an insignificant effect on the overall picture quality when compared to the coarseness of the line structure of the TV screen. Nevertheless, despite this coarseness—or perhaps because of it—pictures shot from the television can sometimes have an impact and immediacy that is lacking in conventional photographic material.

Taking photographs

Before photographing the screen, make sure that you have the best possible reception on the set. Check the fine tuning, and adjust the aerial until you have a clear, flicker-free picture. It is easiest to do this when the test card is being broadcast, as this has a range of colours, a scale of black and white—some test cards also have a flesh tone.

Once you have a good picture, lower

Steve Mansfield

Mixed lighting *Flash and available light must be mixed in a way which gives a shutter speed of 1/15 second or slower. The brightness of the TV is then altered*

the contrast slightly. This is necessary because most people prefer to view a fairly contrasty picture, but when this is photographed on to film, contrast tends to rise. So to maintain reasonable contrast in the photograph, the picture on the screen must be of lower than normal contrast. By using the brightness and contrast controls in combination, you should be able to adjust the picture so that detail is visible in both highlight and shadow areas.

Draw the curtains to darken the room as much as possible. Patches of light from table lamps and windows are invariably reflected in the convex surface of the screen, and darkening the room eliminates these distracting flare spots. Furthermore, if the television is photographed in a blacked-out room, the screen appears against a plain black background, and the shape of the set itself is eliminated.

Set the camera on a tripod, so that the lens is level with the middle of the screen. Adjust the distance so that the screen fills the frame, and make sure that the camera back and the surface of the television screen are parallel.

When photographing with an SLR, try to focus on the screen lines or dots, but if you find this difficult, place a piece of paper with some text on it against the surface of the screen, and use this as a target. Non-reflex cameras that do not have rangefinders must be focused by careful measurement with a tape or rule.

Exposure measurement is quite simple, because one of the settings—shutter speed—is more or less fixed by the scan time of the television. You must use a speed which is fast enough to stop movement on the screen, but slow enough to record at least one full scan of the screen. This really means that you can shoot only at 1/15 or 1/8 second. With static subjects, 1/8 second exposures give an image which is free of dark and light bands. But if the subject is moving, 1/15 second may be too slow.

You can determine the correct aperture by using the built-in meter of your camera, or by experiment. A setting of 1/8 second at *f*/5.6 is a good starting point, and you should bracket heavily on either side of this basic setting. Ideally, make a series of exposures at half stop intervals, over an aperture range of *f*/11 to *f*/2.8, all at 1/8 second.

Even if you use a TTL meter, a test roll of film can be a useful guide to the colour balance of your TV. Few sets are perfectly matched to daylight, and most produce a blue or magenta cast. To correct for this, use a filter of the complementary colour. With negative film this is usually adequate, often because you can correct minor colour casts at the printing stage. But for really important pictures on slide film, you may need to make a second test.

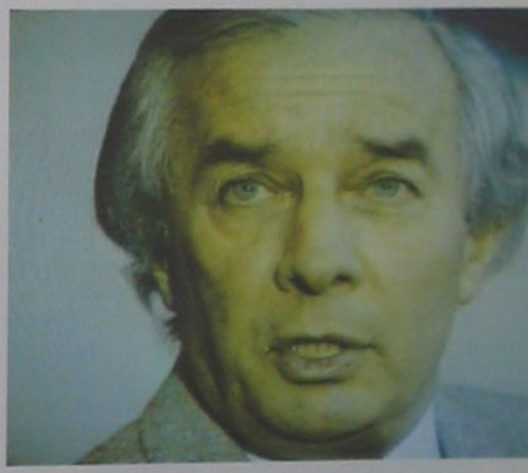
Since you may have to change the settings on the television between your colour test and the actual picture session, make a note of the position of each control knob so that you can repeat the exact brightness and colour with some accuracy. Leave the television running for half an hour before the colour test and photo session, because most receivers take this long to settle down to a stable state. During the warming-up period, colour and brightness may change significantly, but too slowly for you to notice.

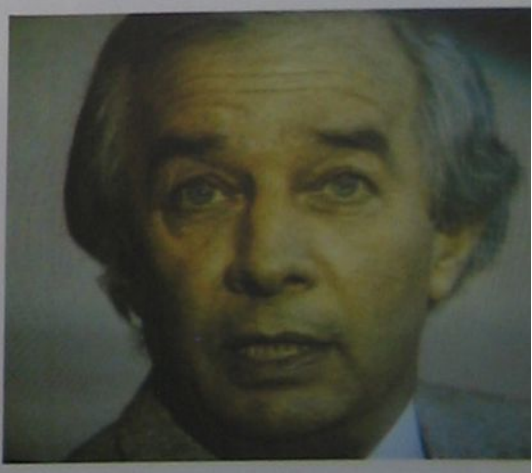
Finally, do not use flash, as this will simply wash out the screen, and all you will see on the film is a grey rectangle, with a reflection of the flash in the middle of it!

Clive Helm

Monochrome set *In spite of their name, black and white sets actually give a very blue picture, which is particularly noticeable when photographed in surroundings lit by daylight*

Colour balance *Although not as bad as black and white sets, colour TVs also tend to suffer from a blue cast. In the lower shot a 20R red filter has been used to give a warmer tone*

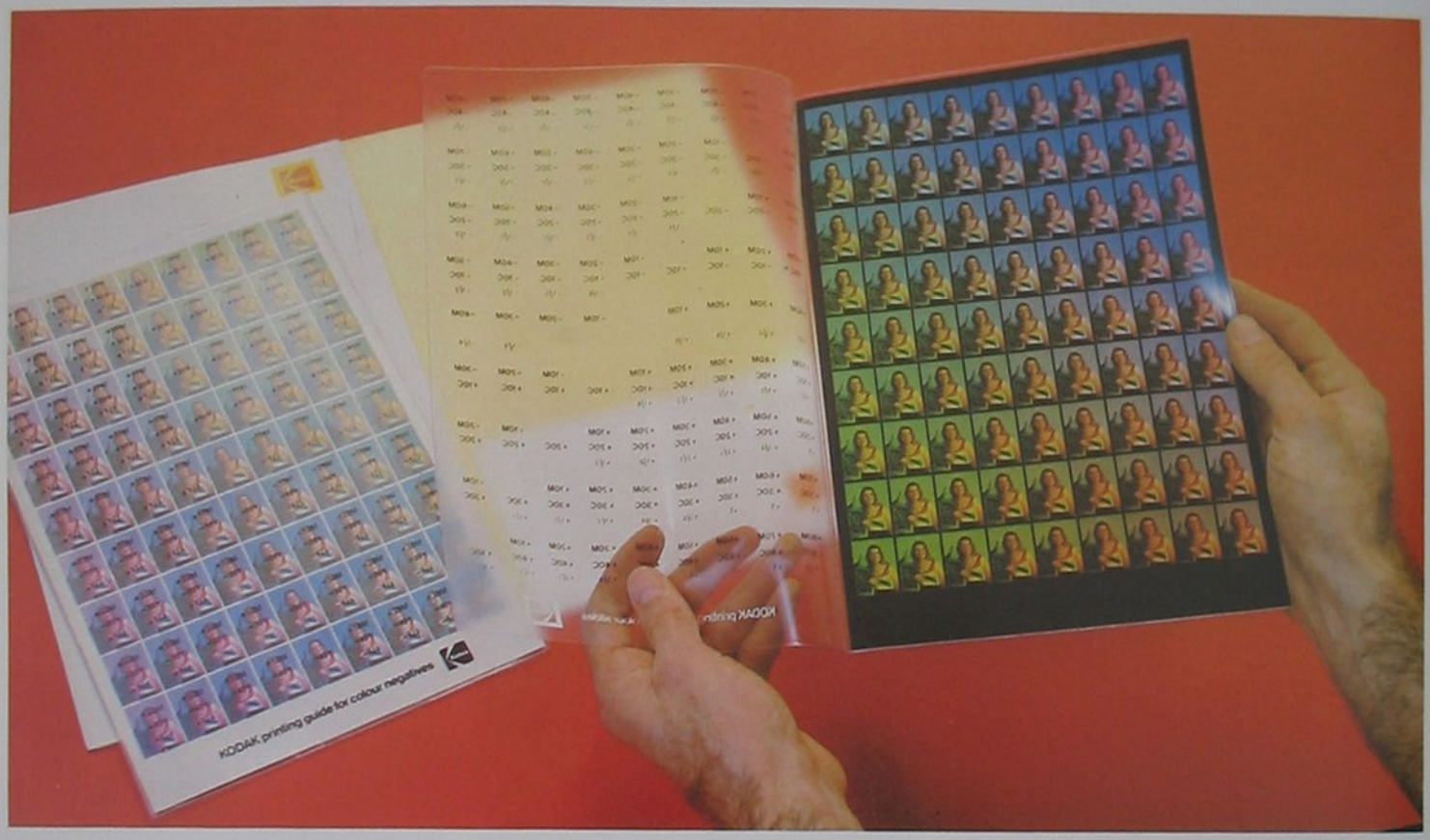




Clive Helm

Quality colour printing

One of the biggest headaches in colour printing lies in recognizing the exact cast, and its extent, on your trial print. For efficient, quality printing a ring-around is invaluable



Robinson/Brown

Colour printing can be very difficult and, even with all the necessary precautions and test prints, results can be inconsistent or disappointing. The only way to ensure consistently good results is to establish an easily repeatable routine for printing and processing. This means taking great care at all stages of the procedure, and making full notes of all relevant data for future reference.

Once you have established your routine, you can begin to work out what factors influence results in practice—especially by adjusting filtration. The more experience you gain, the more control you can exercise to obtain intentional variations. But before you make changes, you must fix your printing routine.

Testing methods

While you can establish filtration by trial and error, you can save time and gain much more control by working systematically. Careful colour tests are essential if you are to produce high quality, well balanced prints. And by writing down what filtration and exposure you use in each successive test, you can record how you arrive at correct filtration, and avoid duplicating your mistakes.

Printing guide *Kodak publish a very useful guide on colour printing which includes these guides on correcting colour casts. One set applies to neg–pos colour printing, the other to reversal colour printing*

Obviously, you have to start with some basic filter combination—most colour negative films need a combination of yellow and magenta—and work from that. A common starting point is 60Y + 80M, but this needs fine adjustment even under ideal conditions. In some cases, it may be completely wrong, and you may have to make a number of filter changes before you achieve correct balance.

One solution is to use an analyzer. This must be programmed from a 'typical' negative, and will give you accurate readings in most cases. It cannot, however, be relied on for untypical negatives, unless it is re-programmed. You can program it to a specific colour or grey tone rather than to a reference negative, if you find that a particular colour often appears in your photographs.

Colour casts are easiest to judge on a neutral white or grey part of the picture. It is not always possible to include these in a photograph, and so one solution is to shoot a couple of frames including these tones at the beginning of each film or sequence of pictures—preferably showing a Kodak 18 per cent grey card. This can be used also for accurate spot measurements and for programming.

Kodak publish a colour printing guide which consists of two sets of pictures printed with deliberate colour casts. Printed plastic overlays indicate the extent of correction required. Such aids can give a valuable insight in to the nature of colour casts but are no substitute for 'grass roots' experience.

Colour ring-around *This is the name given to a colour printing exercise in which colour casts are printed deliberately once correct colour balance has been determined. Suitably mounted, the ring-around gives a useful indication and a ready visual check when you are printing similar work in the future. Colour casts corresponding to 10, 20 and 40 Kodak CP units are shown for red, yellow, green, cyan, blue and magenta (clockwise from upper left). To use the chart, estimate which panel most nearly represents the cast on your trial print, and add the filters shown. For best results, produce your own ring-around*

correct

+10R

+20R

+40R

correct

+10Y

+20Y

+40Y

correct

+10G

+20G

+40G

correct

+10M

+20M

+40M

correct

+10B

+20B

+40B

correct

+10C

+20C

+40C

Robinson/Brown

Identifying colour casts

In some cases, it can be difficult to identify the colours which make up a colour cast—even experienced printers can be misled. The problem is isolating the secondary colour which tints a cast predominantly consisting of another colour—you might have trouble, for instance, with red and magenta, or with blue and cyan. A mistake in this assessment can lead you in completely the wrong direction with your filtration adjustments.

It is helpful to look at the components of colour casts in terms of the filters you can use to correct them—bear in mind the principle of the subtractive printing system. The table on this page shows the breakdown of intermediate colours, formed by the combination of the colours above and below them. The six major colours require correction filters in equal proportions, whereas the intermediate ones require one filter in twice the proportion of the other—a yellow-green cast requires twice as much yellow filtration as cyan.

This makes correction of the intermediate colours simpler. For example, suppose you have a colour cast which you think might be violet or carmine. Since both these casts are partly corrected by magenta filtration, base your initial correction on this colour. The second test print will then show whether the cast was in fact carmine or violet—if it was violet, it will show a cyan cast, because cyan filtration was required, while if it was carmine, a yellow cast in the second print will show the need for yellow filtration.

The presence of a secondary colour cast helps you to cross check the original colour of the cast. If, for example, you are dealing with a cast which could be cyan based but looks blue, you can establish which it is in two steps. Blue requires the addition of blue (M + C) filtration, or the removal of yellow. Cyan requires the addition of red (Y + M). Always start with the smallest change in filtration, if possible—in this case, by assuming that the cast is blue, and removing yellow.

Make your next print—if this shows only a slight secondary cast, the assumption that the original cast was blue-based was correct. If, on the other hand, the second print shows a greenish cast, the first cast did have a cyan base. Go back to your original setting, and change filtration for cyan correction, noting down each successive stage, until you achieve colour balance.

Despite taking the utmost care in your testing, there will inevitably be some images where correction can only be made to some of the colours. This is often the result of failure in the reproduction capabilities of the film-paper combination. For this reason, it is usually a good idea to match films and printing papers of the same brand. Similar problems may arise when you change to a different brand of processing chemicals, or even to another batch of paper. In these cases, there is little you can do—but bear in mind that when there is a choice between a 'cool' and a 'warm' cast, the latter is almost always preferable.

Cast correction

Colour cast	Add	(or) subtract
Yellow (Y)	Y	M + C
Orange (Y + R)	2Y + M	
Red (R)	Y + M	C
Carmine (R + M)	Y + 2M	
Magenta (M)	M	C + Y
Violet (M + B)	2M + C	
Blue (B)	M + C	Y
Ice Blue (B + C)	M + 2C	
Cyan (C)	C	M + Y
Sea green (C + G)	2C + Y	
Green (G)	C + Y	M
Yellow green (G + Y)	C + 2Y	
Yellow (Y)	Y	M + C

This table shows how colours can be 'broken down' into meaningful colour mixtures so corrections can be made using yellow, magenta and cyan filters in subtractive neg–pos colour printing. The presence of a figure 2 indicates that approximately twice as much of this colour is present in the combination. For example, violet requires twice as much magenta correction as cyan

Print viewing filters

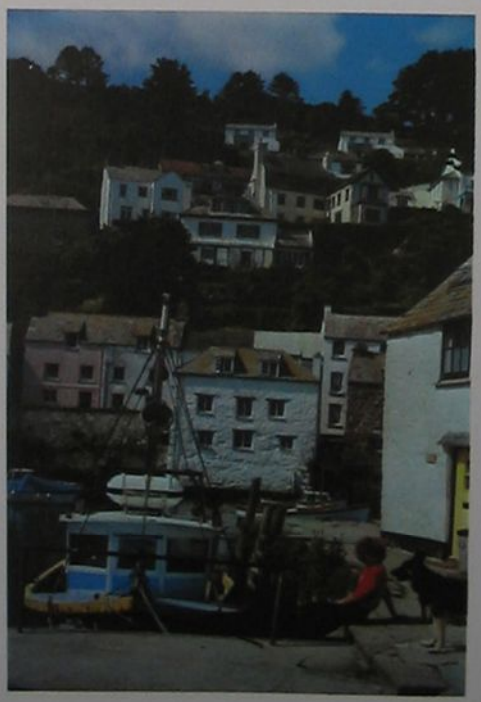
You can estimate the effect of a given colour cast simply by placing a filter complementary to that colour over your colour test print. A print with a cyan cast, for example, looks better when viewed through a red filter—the great advantage of this system is that you can actually see the effects of a filter without going to the trouble of making a test print.

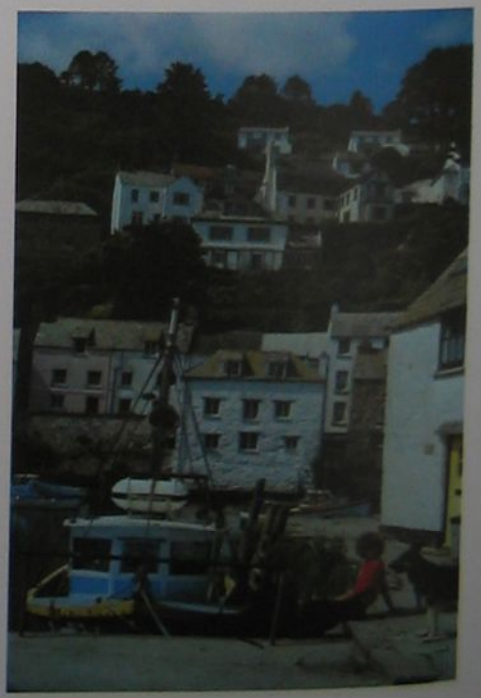
You can even make up packs for print viewing, which is an excellent way of determining in which direction your corrections should go. To do this,

Troublesome casts *If you have difficulty identifying the precise colour of a cast you can easily go wrong when making a correction. The table (right) plots the likely result and puts you back on the right track. For instance, many people confuse cyan and green, particularly if there is a trace of another colour in the cast. In the example (below left), assume that the first print has a green cast and make the appropriate corrections to remove this. Now, if the cast was indeed green, and you had made the right corrections, no major cast should be present on the second print. This is represented by the plain square in the green 'assumed cast' column in the table at right. But if a cast is present on the second print (below centre), locate this colour in the same column and trace left to find what was the actual cast on that first print. The presence of a blue cast on the second print means that the actual cast on the first print was cyan, not green. You can either correct the second print filtration or return to the first print filtration figures to make the necessary adjustment to balance (below right).*

Excessive filtration of the correct filter colour results in a cast in the complementary colour, whereas insufficient filtration will leave a cast in the same colour. So had we assumed correctly that the cast on the first print was cyan but had overcorrected, a red cast would result. To cross-check this on the table would suggest that the original cast was red, not cyan. But it is rather unlikely that anyone would confuse a colour with its complementary. If this happens, the corrective filtration used for the second print must be reduced.

The abbreviations in the table stand for the following colours: C, cyan; R-M, red-magenta; B-M, blue-magenta; B-C, blue-cyan; G-C, green-cyan; B, blue; G, green; Y-G, yellow-green; Y, yellow; O, orange; R, red; and and M, magenta



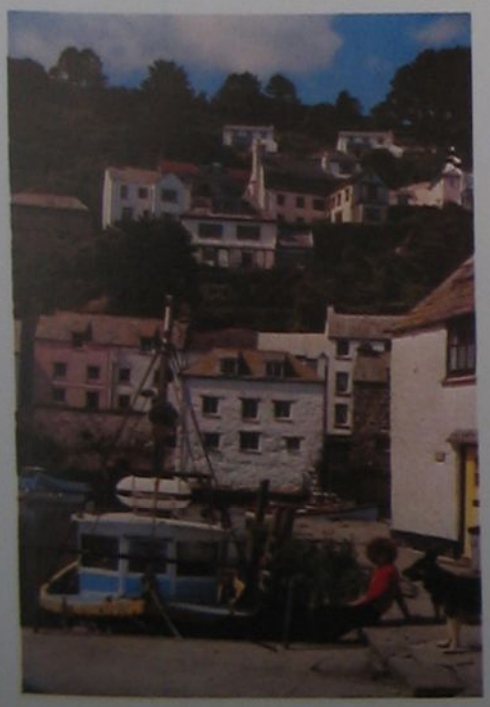


Cast identification table

Actual cast on first print	Assumed cast on first print: YELLOW	RED	MAGENTA	BLUE	CYAN	GREEN	YELLOW
	Colour cast on second test print						
YELLOW		G	Y–G	Y	O	R	
RED	M		Y	O	R	R–M	M
MAGENTA	B–M	B		R	R–M	M	
BLUE	B	B–C	C		M	B–M	B
CYAN	B–C	C	G–C	G		B	B–C
GREEN	C	G–C	G	Y–G	Y		C

proceed in exactly the same way as you would in printing but subtract the colour which appears to correct your first print, or add the complementary. Then, make the change which seems acceptable in the filter pack for the actual exposure.

One problem with this method is that you have to gauge how much filtration to introduce in the enlarger, simply by viewing the print through a filter. As a rough guide, if the print looks right when viewed through the viewing filter, halve that filter value for the enlarger and use filters the same colour as the cast—complementary in colour to the viewing filter. Thus, if a strong cyan cast is corrected by viewing with a 20R filter, use 10 units of cyan correction when adjusting the filter pack or colour head for the next print. If the viewing filter overcorrects the cast, try a lighter one, or apply even less correction, say 5 units. If the filter corrects the cast when actually laid on the print, try using the same unit correction.



Making a ring-around

Making tests is the quickest way to produce a colour print. But the best way to get to know about colour casts is to print them deliberately, in a controlled way. One way of doing this is to make a *ring-around*—a range of possible casts—which you can use for reference when checking later on. For this, you need to make a number of colour prints.

To save paper, use a masking easel, such as the Durst Comask, which allows you to make four prints on a single sheet of paper. Choose as your standard reference negative one which has as wide a range of colours and tones as possible, and make a perfect print from this. Next, take a sheet of colour paper and make four exposures on it, all with correct filtration but with different exposures—one correctly exposed, the others with ¼, ½ and double the exposure.

On another sheet, make a correctly exposed and colour balanced print, and three more, with 10, 20 and 40 units of any colour cast—use a cyan filter, for example, to produce a red cast. Remember to adjust exposure for each of these prints. Make similar sheets for all five other colour casts. Remember to make a note of all information for each exposure you make. You should now have a range of seven prints, each with four exposures, and one each for yellow, blue, magenta, green, red and cyan casts.

If your negative is representative of your work, you can use this ring-a-round to determine filtration for future prints, by comparing them with the appropriate cast in your selection. It is then a simple matter, in most cases, to establish what filtration to use.

Processing routine

Even the most accurate filtration and exposure tests are useless if you do not take the same amount of care over your processing. This means scrupulous control over processing times and temperatures, as well as cleanliness of all processing equipment. Colour processing, especially drum processing, takes longer than black and white, and this can be tedious sometimes. Do not, however, be tempted to take any 'short cuts'—this can lead to contaminated solutions, and colour casts or blotches on your prints.

The most important aspect is the sequence itself. In each stage, you must decant small quantities of chemicals without spilling, and discard them after use—all this while keeping an eye on both temperatures and the clock. It is essential to practise the sequence—the more you are used to it, the less likely you are to panic, and spoil your results or contaminate solutions.

There are two methods of temperature control in colour printing: the presoak method, in which the tank, previously soaked in hot water, transfers heat to the developer; or the conventional waterbath method—which keeps solutions at a constant temperature. The first is convenient in that it does not require you to set up a water bath, but you can run into problems with temperature control because of the many variables involved. If, for instance, you do not take into account the room temperature, the accuracy of your whole process can be placed in jeopardy.

The best way to ensure accuracy is to make your whole procedure as simple as possible—prepare everything beforehand, so that when you start your run there is little chance that anything will go wrong—it will be all the easier to repeat your routine for consistently good results.

Assignment

Scrapyard

Sending a photographer to a scrapyard on a wintry day and expecting a set of good photographs may seem like a recipe for disaster, but it is a subject that suits an eye for shape and colour

A scrapyard is a likely place to find an inlet manifold for your car, but surely a greasy, muddy yard full of rusty torn and twisted metal is the last place you would go to take creative photographs—especially on a dreary overcast day? We decided to see just what could be done in such an unlikely place—perhaps it would actually be an ideal location—or perhaps it would show just how much good pictures depend upon the creativity of the photographer. We sent John Sims to a particularly dull scrap yard on a grey overcast day, giving him no brief—just to see what he could produce out of such seemingly inauspicious surroundings.

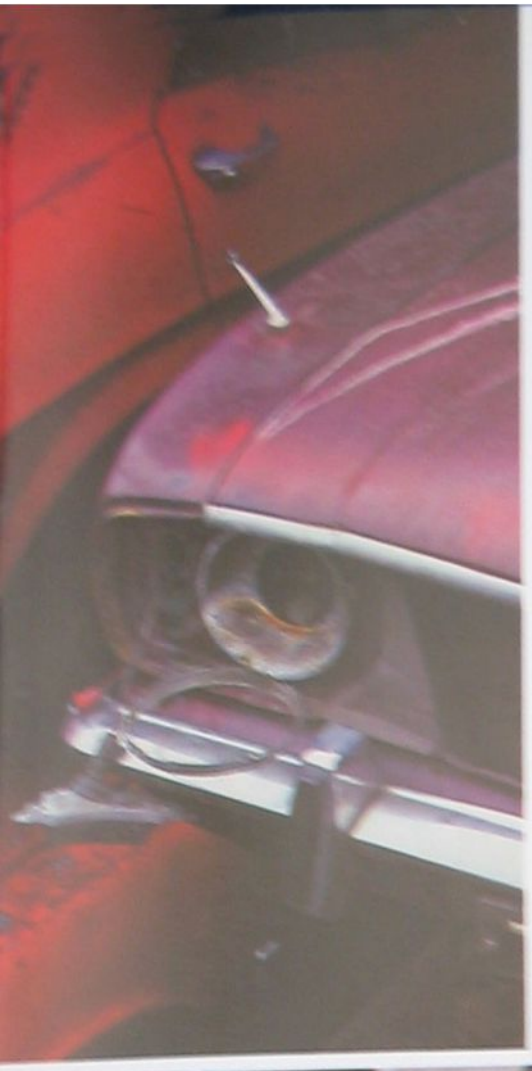
"Well here we are . . . now what?" At first it seemed a totally ridiculous exercise but, after walking around the yard for a few minutes, overwhelmed by the apparent lack of photographic subject matter, it began to appear that a scrapyard is not quite such a bizarre subject as it might seem at first. Moreover, the soft overcast light proved highly suited to the metallic surfaces and the muted colours—it also created even contrast so there were no dark shadows or bright, glaring highlights. A broad overview of the yard is visually deceptive, though a closer inspection which started as a dress rehearsal for shots began to reveal a myriad of subtle colours, shapes and textures. So John carried on taking pictures from there and, with careful framing, transformed the twisted wreckage into bright, colourful transparencies.

A macro lens proved one of the most useful pieces of equipment for dealing with this subject, allowing John to close in to within a few centimetres of his subjects. At such close range with subjects that were not perfectly flat, it was important to use a small aperture to give a great enough depth of field to hold the whole subject in focus. In low light this meant slow shutter speeds and John used a tripod for nearly all his shots.

Careful control of depth of field does not apply only to close work. John also used his 80–200 mm zoom extensively, and with this lens he was always careful either to throw the background out of focus or to render it sharply.

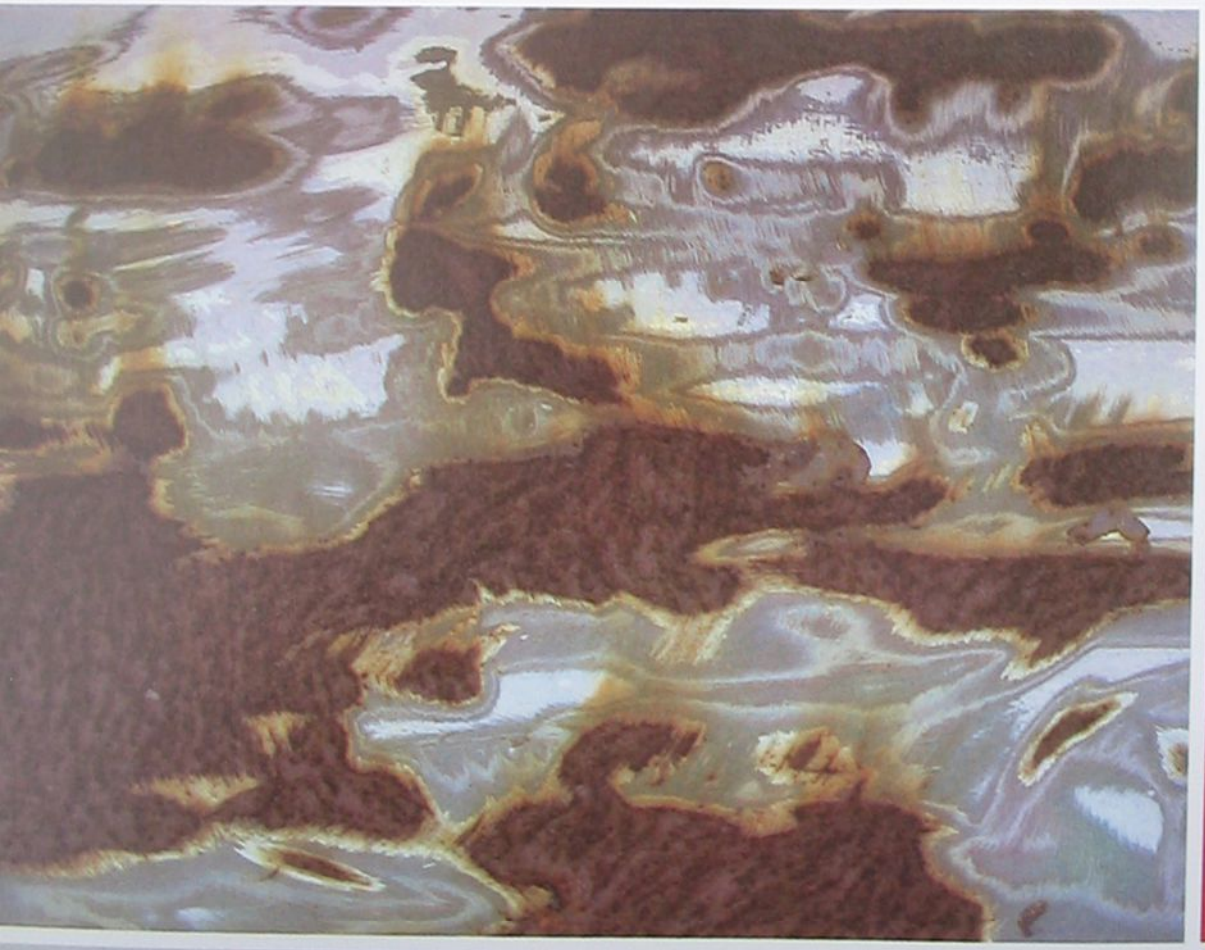
Broken nose *John closed in on a group of three cars stacked together, and used an 80–200 mm zoom to frame the shot. This gave enough detail to identify the subjects and exploit their strong colours, but left out their full context*

Outside view *At first the yard seemed to lack potential, but John found a viewpoint showing derelict cars haphazardly piled around and a lamppost to enliven the featureless sky. A graduated filter improved colour*



Corrugated fence *Careful observation —noticing a subject and then seeing an effective way of photographing it —is vital to bring out beauty in such a cluttered, messy place. John noticed the reflection in this car's roof and used his 20 mm lens to fill the frame with colour*

Diagonal view (bottom) *A scrapyard is full of different shapes and patterns, but these have to be organised to produce 'tidy' images. Here, John decided it was not essential to present the scene exactly as it struck the eye—he angled his camera until he saw the shapes he wanted*



Twisted wreckage *John first tried a straight shot of this wrecked car, but realized that including the pale sky would make the final photograph look stark and colourless. The addition of a pink graduated filter made all the difference—bringing warmth and colour to the scene (35 mm lens)*

Rusted paintwork *In these two photographs of corroded car bodywork, a 55 mm macro lens brought out the texture of the rust while the film used—Kodachrome 64—faithfully reproduced the subtle colours John prefers soft light for his colour, but this meant using a tripod for all the shots*

Junk sandwich *To get this view, John scrambled to the top of a pile of cars, and used a 15 mm lens to show the pattern of cars laid to rest in rows.*
Cylinder block *The extreme sharpness of a macro lens is illustrated here, but at such close range, John had to stop down to f/11 to ensure all the bolts were in focus*

John Sims

Angus Forbes/Leo Burnett

Painted into a corner *This picture was used in a campaign by the London 'Times' newspaper with the theme 'Have you ever wished you were better informed?'*
Angus Forbes *His pictures look deceptively simple, but they are all elaborately assembled—as here*

World of photography

Angus Forbes

'Chaos to order' is what this London based advertising photographer says he produces. Using multiple exposure and a well developed sense of humour, he often produces images of abstract ideas

In the tough, competitive world of advertising, Angus Forbes is among a talented minority of photographers whose images are truly distinctive. Superb multiple exposure techniques combined with a mischievous sense of humour have been his trademarks since 1974 when he set up his studio, called *Dirty Tricks Department*, in the heart of 'legal' London.

His business card says he is expert in producing 'pictures that exist only in your mind', and he describes his work as 'controlled chaos'. His pictures are, indeed, unusual and often contain outrageous ideas. But there is certainly nothing chaotic about the end results. Their precision finish gives little indication of the complex and elaborate preparations that go to make them up.

Whenever he is commissioned for a job, he painstakingly assembles the ingredients for the art director's ideas for an elaborate multiple exposure. He then works out, in conjunction with the clients and the art director, the composition which will give the most striking image. Only then does he go back into the studio to try out the exposures for the final shot.

Sometimes the final image is so simple that it is difficult to appreciate the amount of work that has gone into their preparation. Even the most basic idea usually has to be completely constructed in the camera. Renault, for example, wanted to feature that inviting moment when the cork 'pops' from a champagne bottle, in an advertising campaign. They looked everywhere for a library shot of a popping champagne cork before they approached Angus. 'The shot may look simple but it took four separate exposures on the same 10 × 8 sheet to capture the whole action.'

First Angus photographed the foaming neck of the bottle by flash. Next the cork was aligned exactly with the bottle neck, wired to a black background and exposed. A blur effect for the moving cork was added by a time exposure with tungsten light as the shutter was held open. And cigarette smoke was added for the final touch.

Angus began experimenting with multiple exposure techniques while shooting a gift catalogue. 'I thought if I labelled myself Dirty Tricks Department people would gradually begin to see the possibilities of doing things within the camera—not necessarily having to make dye transfers (see page 1350) where you always loose quality at every stage.'

Angus Forbes/Vincci

Butterfly *Both spot and snoot lights were used to get the maximum shadow effect from the butterfly on this shoe*

Icarus *The man who thought he could fly. This picture was also part of the 'Times' newspaper campaign. The feathers were glued to special black netting so they could be moved separately, yet still appeared to be plumetting down along with the ill-fated flyer*

shot is depth of field. Look carefully at some of posters you see and you'll find that there is a loss of focus between the set and the background. It's a dead giveaway. The other thing that has to be carefully contrived is the lighting. My tutor at college had worked as a police photographer and was naturally a stickler for detail. Although at the time I thought "this is not what photography is all about"—it's probably why my work is now so hard edged—I unconsciously pay particular attention to detail.'

Forbes' photographic skills are undoubtedly important, but it is his dry sense of humour which appeals to art directors. The touch of humour must often be surprisingly subtle if it is to work. A photo he took for a credit card company showed the card painfully impaled between a customer's shoulder blades. 'To draw attention to the product I let the figure go into complete blackness—obviously it's a man's face. It seemed pretty evident what was happening without having to show him in pain, which would have detracted

Multiple exposures involve two main technical problems. First, perfect registration so that each separate image is recorded in exactly the right place in the frame. Second is getting the exposure right for a series of up to ten shots on a single frame.

To make registration easier, and for high quality, Forbes uses the giant 10 × 8 inch format of his Sinar camera whenever possible. Working on black backgrounds Angus masks out the areas he wants to remain black by using a special external iris in front of the lens. He closes this down so that only the area he is photographing is visible on the large ground glass screen of the Sinar. He then draws or traces the images on to the screen and matches the various components with a shot on black and white Polaroid film before beginning the main series of exposures on Ektachrome sheet film.

Forbes owns two complete Sinar 10 × 8 inch outfits with a full set of lenses from 65 mm to 610 mm. Many people only hire equipment like this, but he believes that for his type of work hiring would be uneconomic. 'I might want to use a different lens on each part of the multiple exposure. We have to have these tools at hand to work out the effect of a particular lens on the spot.'

Almost all his work is done in his own studio and calls for flash, but occasionally Angus uses tungsten for various effects suggesting movement.

Often, people are completely baffled by the success of his multiple exposure techniques. Angus particularly enjoys inviting visitors to his studio to locate the 'invisible' join between a posed model and a clever studio mock-up featured in a photograph for a lager campaign. Few, if any guests can find it. 'The background is usually a stock shot while the foreground has to be built up and photographed. The problem with this sort of

Angus Forbes/Leo Burnett

Angus Forbes/Harrison Cowley

from the insidiousness of the back stab.

That shot was taken first on Polaroid and presented to the art director who immediately liked the idea. Although advertising photographers lend much to the art director's ideas, Angus insists on the distinction between 'interpretation' and 'imposition'. 'I don't impose anything if I'm given a brief. I put my energy into it which may end up slightly different to how the art director envisaged it.'

Another campaign for Independent Television in Britain was based on the atmosphere of the film *Jaws*. It featured a shark's fin with the invitation underneath —'Come on in, the water's lovely'—to encourage companies to advertise their products on television. A specially made fin about half a metre high, was pulled across a specially constructed 3½ metre square tank. The water was 30 cm deep. 'I wanted the tank so big to avoid problems of scale. You can't alter the

Champagne cork *That wonderful moment as the cork takes off was recreated by means of four separate exposures*

Exploding cereal *Forbes was asked to illustrate a campaign selling 'the breakfast bomb'*

size of water drops and in so many movies, details like that give the whole game away.' Using a combination of both strobe and flash lighting, in conjunction with precise baffling techniques, the fin was pulled across the tank for a series of exposures to fill in the various areas of the negative. The baffles meant that the pool and rails were not recorded. 'This was an example of using multiple exposure to rub things out, rather than being an additive process as it is usually.'

He estimates that at least six photographers will be competing for every commission he or his agents in London or New York pursue. However, his skill with trick photography has enabled him to create what he calls 'a self-expanding' market.

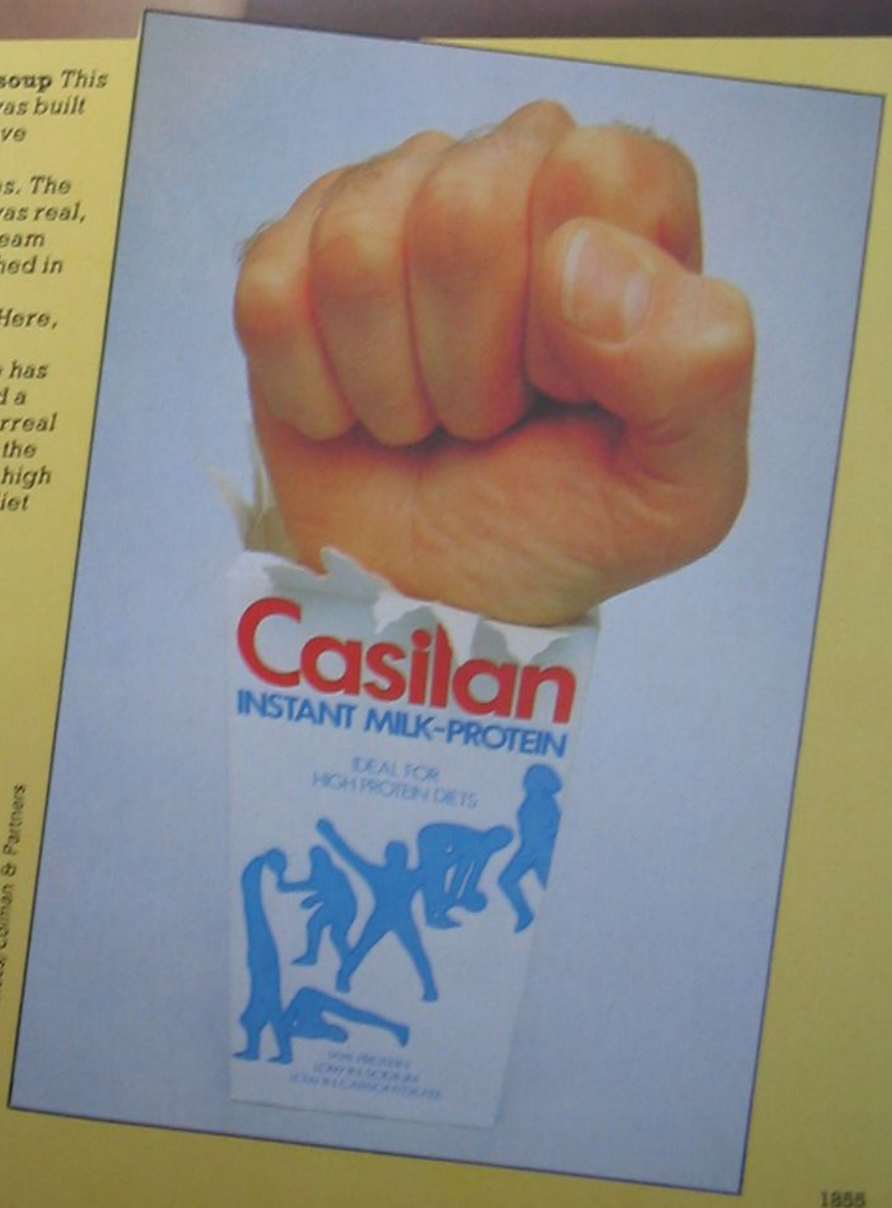
Art directors who understand Angus's techniques often visualize assignments especially suited to his 'dirty tricks' approach. A good example is his advertisement for White Horse whisky which makes striking visual puns with reflections and perspective.

An Australian, Angus trained in photography at the Melbourne Institute of Technology before he moved to England in the mid 1960s to work on mail order catalogues. Technically, this was an invaluable experience. 'It was a job—I was actually taking photographs. Even though the subject matter was fairly mundane I had a studio at my disposal where I could come in at weekends and play around with a 10 × 8 inch camera, which expanded my photographic horizons.'

The first 'Dirty Tricks' photograph was taken when he was working on a toy

Tomato soup *This picture was built up with five separate exposures. The bubble was real, but the steam was touched in*

Casilan *Here, a single exposure has produced a highly surreal effect for the pack of a high protein diet product*



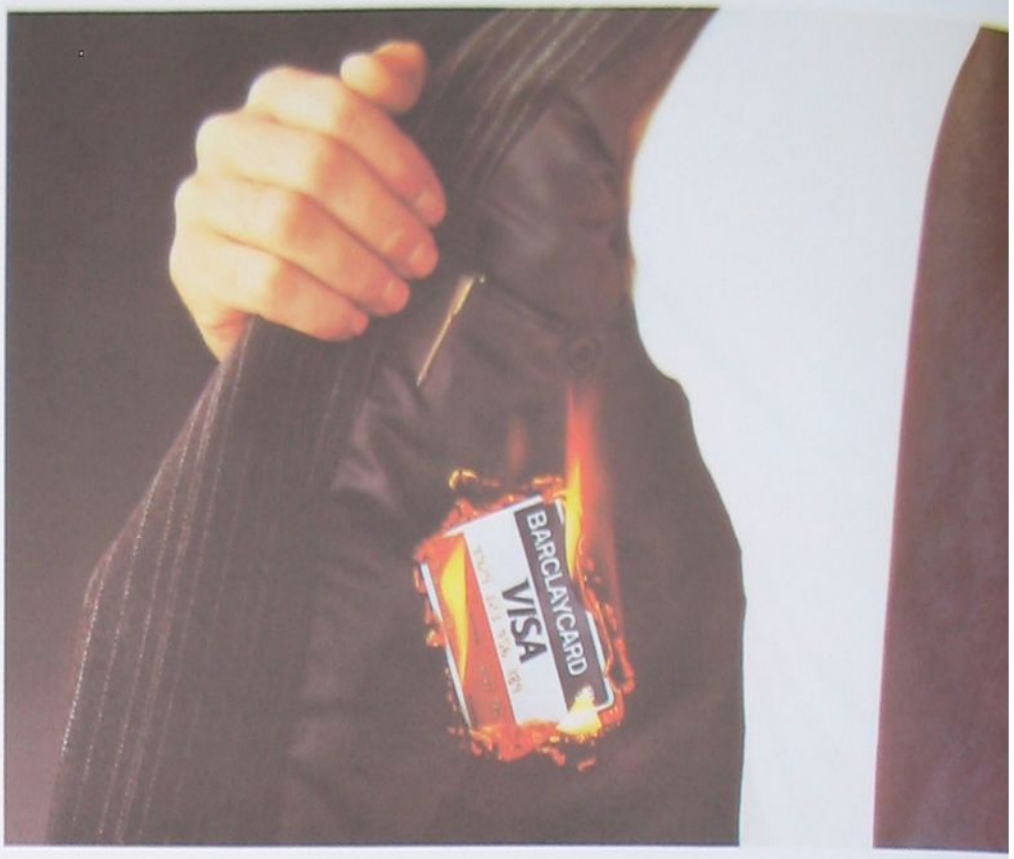
Angus Forbes Colman & Partners

Angus Forbes Rythme Alpha

catalogue. 'I decided to have a bit of fun for myself. I had been photographing a mechanical shovel. There was a building site down the road so I got a workman in and double exposed him into the mouth of the shovel.'

Angus had arrived in England fascinated by the quality of advertising posters and this eventually developed into a burning urge to see his own pictures blown up on to enormous hoardings. He learnt the trick techniques of more experienced photographers by simply tearing out adverts from *The New Yorker* and *Esquire* and painstakingly reconstructing their riddles. 'It was just a matter of deduction really, and experimenting with light.' One result of this exploration was that Angus had to relearn all that his college had taught him about lighting.

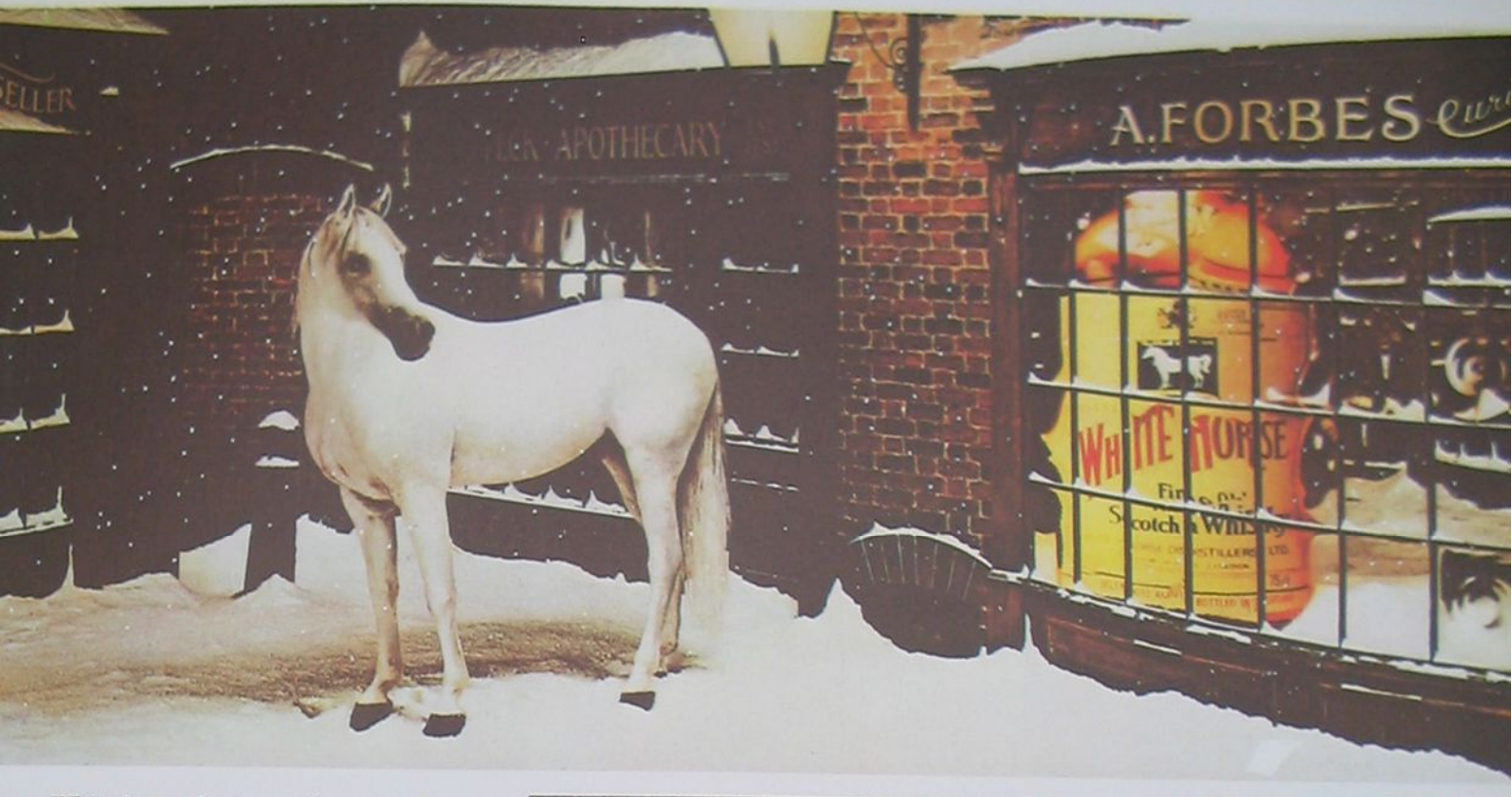
A copy of *The Art of Walt Disney* dominates a bookshelf in Angus's studio.



Angus Forbes/Collett Dickinson Pearce & Partners

Credit card *'Money burns a hole in your pocket' so the saying goes, but here, courtesy Forbes, it's a credit card*

Tyres *A deceptively simple image of tyres in the rain, carefully created for ICI Fertilisers*



White horse *Photographed with the whisky company's own specially trained horse, on a full-size set*

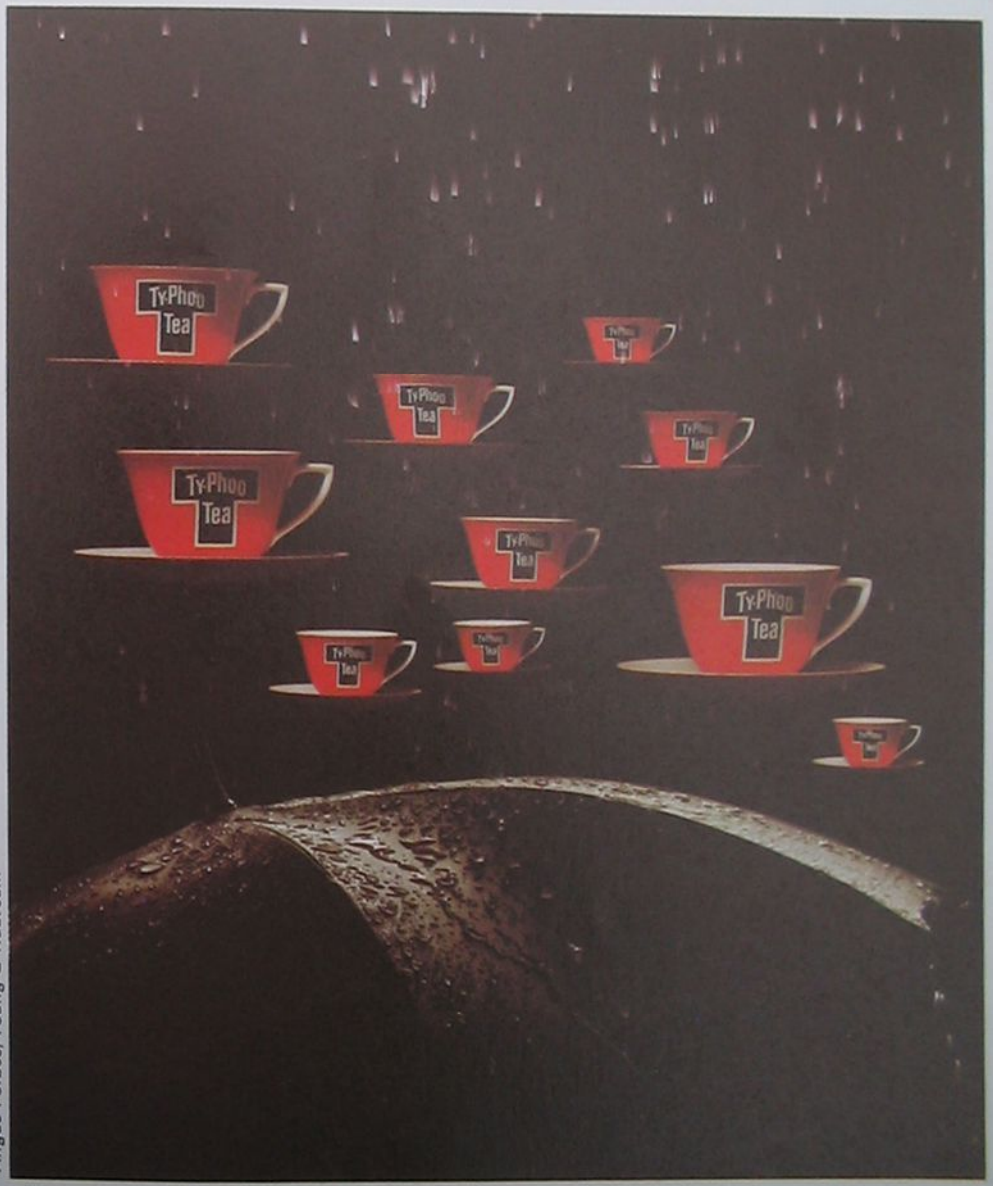
Raining teacups *This was an early assignment (1975), relying heavily on the painter Magritte for inspiration*

In his early teens he had wanted to become a film animator. 'I know it sounds pretentious but I would like my pictures to be ''Disneyesque Magritte-isms'' that is, slightly fairy tale-ish.' He traces the influence of the Belgian Surrealist painter Magritte back as far as his first successful assignment for an English tea company—a picture of teacups 'raining' down on umbrellas.

'It was fairly evident that Magritte was behind some of the roughs I was asked to interpret photographically. So I went straight down from the agency and bought every Magritte book I could. Magritte haunts advertising—especially in the photographic area because he's so ''photographic'' a painter.'

To keep himself—and his work—fresh Angus takes regular breaks from the studio to shoot location stills for movies. *The Shout* and *Mad Dog* are two of his projects. But it is to advertising where he must look for the true patrons of 'dirty tricks'.

London is his favourite commercial base, not least because British advertising accommodates humour. One of his favourite pictures, taken to promote *The Times*, shows an aerial view of a decorator, shot from a scaffolding gantry, trapped in a corner by a still-tacky painted floor. 'That is selling a newspaper! That's wonderful. In what other country in the world would you take a picture like that to sell a newspaper?'



Angus Forbes/Young & Rubicam

Angus Forbes/Allen Brady & Marsh

Understanding...

Mirror lenses

Capable of giving extremely long focal lengths in a short, compact lens, the mirror lens often seems to be the latest in lens technology. But its origins date back to the days of Sir Isaac Newton

Mirror lenses are becoming increasingly popular with both amateur and professional photographers because they are much more compact than conventional lenses of similar focal lengths. By using mirrors to focus the light, some of the problems encountered with long focal length lenses—such as chromatic aberration—are avoided or reduced. The optical principles of mirror lenses are quite straightforward, although their layout does create special problems both for the designer and user.

The mirror lens design is often regarded as a recent innovation, but its origins actually predate conventional achromatic lenses. In the late 1600s, Isaac Newton discovered that the coloured fringes which degraded the images from the primitive telescopes of that time were due to *dispersion*. This is the way glass, or any other substance, splits light which is refracted through it into separate colours, and is the cause of chromatic aberration.

Unable to devise a cure, Newton abandoned *dioptric* lenses (those using refracting elements) and used curved mirrors instead. These do not disperse light as no refraction is involved.

The mirrors were surface silvered to avoid double reflections, and made concave. In this way they acted just like optical elements in that they focused light to form real images. The main problem was that the image was formed in front of the mirror. But this was solved by putting a secondary flat mirror part way up the telescope tube to reflect the rays through 90° to form an image outside the tube. This two-mirror design is called a Newtonian telescope and is an example of a *catoptric* lens—that is, one using mirrors only.

This basic layout has been extensively developed. One of the most important improvements was the *Cassegrainian* telescope where the secondary mirror 'folds' the light path back down the tube through an aperture in the main mirror, rather than out through the side. This means that the viewer (or camera) is directly behind the lens, which is more convenient. So it is this design which provides the basic for photographic mirror lenses. The folding of the light in this way also gives a lens which is about one third the length of a conventional lens.

Sergio Dorantes

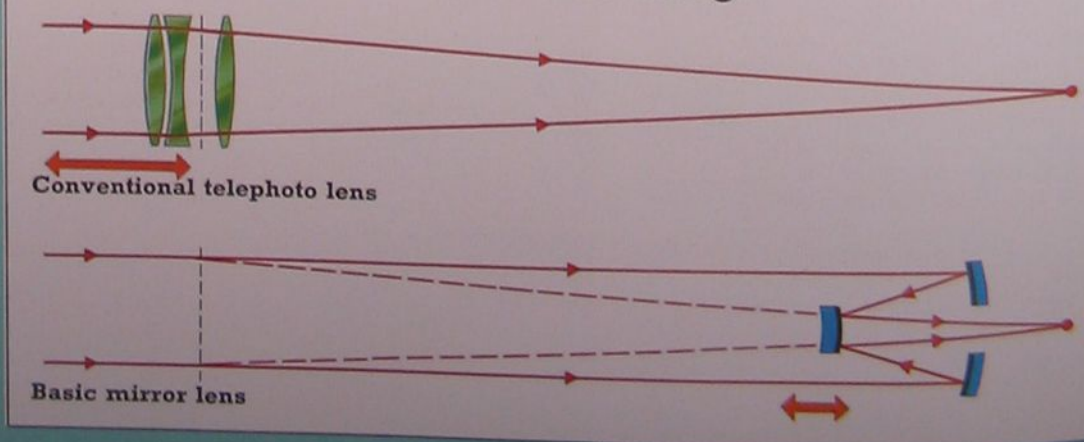
Ghosted flowers *The depth of field with a mirror lens is very small and cannot be improved by stopping down, as usual. Defocused images may have a ghostly appearance*

Catadioptric lenses

Another improvement was made in the 1930s when Bernhard Schmidt showed that a specially ground aspheric lens, mounted in the front of the mirror lens, greatly improved performance by reducing spherical aberration. Although the cost of such a design effectively rules it out for photographic use, the principle of using both mirrors and lenses—that is, a *catadioptric* lens—has since been widely adopted; all modern photographic mirror lenses are catadioptric.

Although Schmidt's idea was itself impractical, ten years later two designers working independently of each other—Bouwers and Maksutov—made the dis-

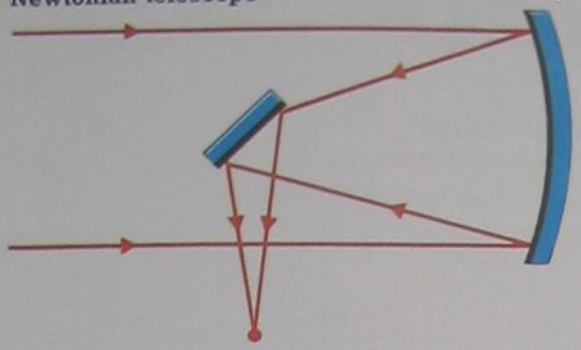
The advantage of mirror lens design



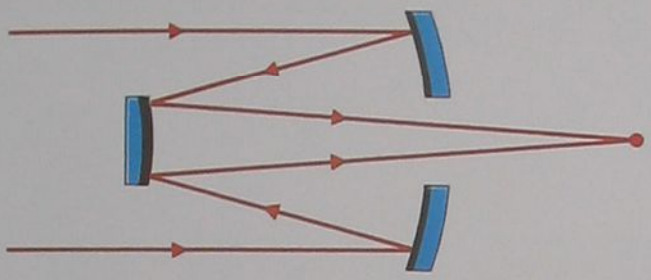
Paul Williams

Mirror lens types

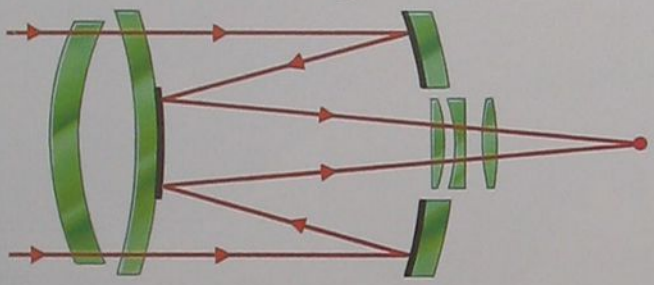
Newtonian telescope



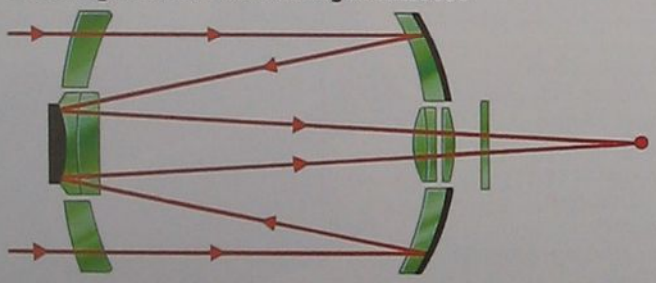
Cassegrainian catoptric telescope



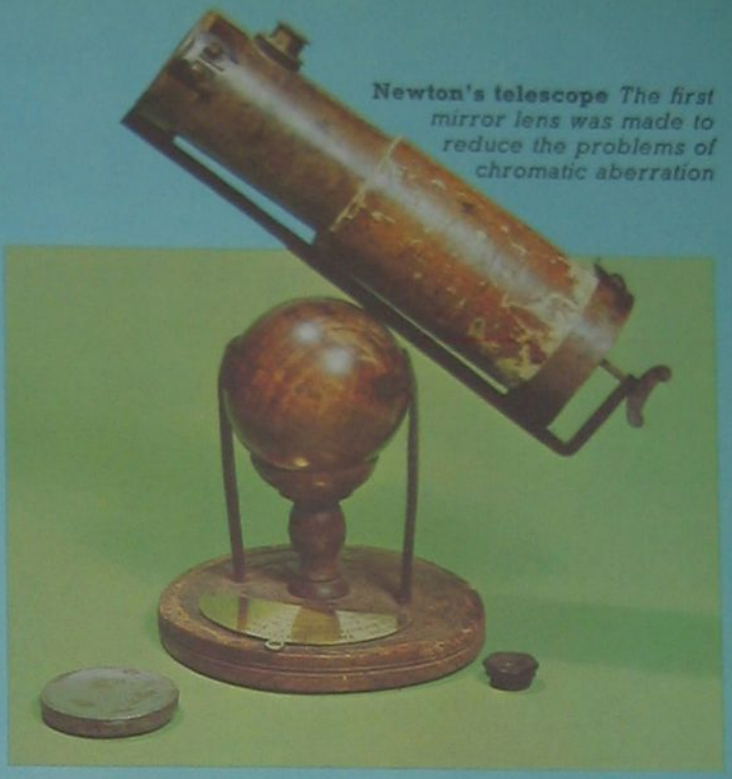
Bouwers-Maksutov catadioptric lens



Catadioptric lens with Mangin mirrors



Paul Williams



Newton's telescope *The first mirror lens was made to reduce the problems of chromatic aberration*

The Bridgeman Art Library

Mirror lenses *have come far since the original Newtonian design—from the mirror hole in the Cassegrainian allowing the viewer to see forward, through the first practical design to include lenses—the Bouwers-Maksutov—to the rear silvered spherical elements of the Mangin mirror*

Mirror advantage *By folding light rays, mirror lenses can be focused right behind the rear element, giving a short lens even with a long focal length—a conventional lens of similar focal length may be three times as long*

covery that made catadioptric lenses a much more practical solution to the problem of spherical aberration. They discovered that simple spherical mirrors give adequate results if a large meniscus lens, also with spherical surfaces, is placed at the front of the tube. The spherical aberration of one is effectively cancelled out by the other. This *corrector* lens is also useful for positioning the secondary mirror.

Many catadioptric lenses—particularly 500 mm *f*/8 models—are of the Bouwers–Maksutov Cassegrainian type, though they are usually slightly more complex. Additional elements are normally used to flatten the image field and correct colour aberrations, and common designs use five to eight elements in all.

An alternative approach is to use a *Mangin mirror*. This is where, instead of using surface silvering, the silvering is applied to the rear of spherical lenses, so giving greater protection. The lenses also give the necessary corrections, allowing apertures of up to *f*/5.6. Combining elements and mirrors in this way allows very compact lenses to be made, and close focusing is possible with only a few millimetres extension of the secondary mirror.

The fact that small movements of the mirrors can have a great effect on focusing is also a problem. It is essential that the elements remain correctly aligned. Small knocks which would have a negligible effect on a refracting lens can cause serious problems with mirror lenses. And changes in temperature, which cause expansion or contraction of the lens materials, can create a focus shift. This is why mirror lenses always focus past infinity.

Another problem can arise with filters. The very large diameter of the front element makes front mounted filters impractical, both from the point of view of cost and optical quality. So with most mirrors lenses the filters are rear mounted, often in the form of a built in 'turret'. So these filters behave as additional optical elements and the lens is designed to take them into account. So when a coloured filter is not in place, a clear glass (UV) filter must be used. Without a filter, the optical performance of the lens is impaired.

Mirror lens speed

Mirror lenses rarely have diaphragms for varying the aperture—partly as such a device would have to be very large. But it is also concerned with the problems of retaining a perfect *annulus* (doughnut shape) over such a large area. Any distortion of this annulus results in degrading of the image.

With no diaphragm, the aperture of a mirror lens cannot be varied so the correct exposure is achieved by altering the shutter speed or placing neutral density filters over the lens. The *f*-number for any particular lens is calculated with normal optics geometry by dividing the focal length by the aperture, which in this case is represented by the main mirror.

This calculation gives the quoted speed—say *f*/8—but the secondary mirror blocks some of this aperture. So in terms of actual light transmission the aperture may be reduced by as much as a stop, giving *f*/11 in practice.

Equipment for 3-D

Though very little stereo equipment can be bought new, many items of old, used equipment are still available and can be adapted to open up this fascinating branch of photography

One of the attractions of stereo photography is that quite effective results can be achieved with little or no special equipment. Nevertheless, using cameras and attachments specifically designed for this type of work can add greater sophistication and consistency to your work.

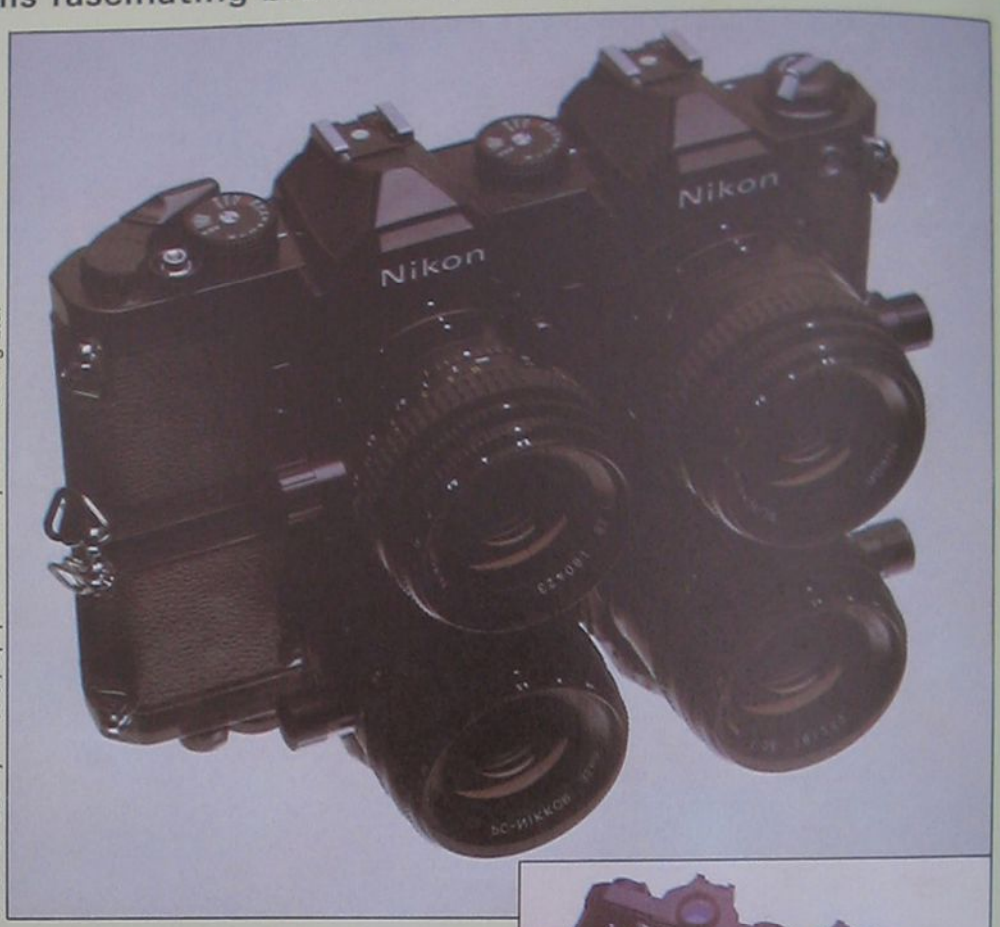
Unfortunately, with the exception of a few very expensive and specialized cameras, there are only a few items of new equipment on the market today. Unless you are prepared to make your own equipment, then, you are left with three main choices: you can use a slide mechanism with an ordinary camera; you can buy used equipment; or you can use a stereo *beamsplitter*.

Slides and beamsplitters

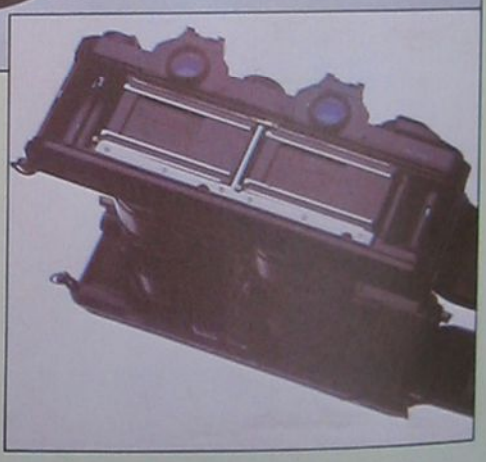
The stereo slide is the simplest and cheapest equipment. All you need is some sort of jig which allows your usual camera to be moved sideways between exposures. Some people make their own and some use macro focusing rails or similar appliances with the camera mounted sideways. You can use any camera of any format, and the distance you move the camera between exposures is readily variable. This is particularly useful as, although a movement of around 60 mm is fine for most subjects a smaller separation is desirable for close-ups, and a wider separation allows you to produce startling landscapes. The main drawback is that you are limited to static subjects.

Beamsplitters are another fairly simple option. These attach to the front of a normal lens and use mirrors or prisms to split the field of view. The taking windows are around 60 mm apart, and the two images are brought together so that they enter the camera's lens side by side.

There is at least one beamsplitter still available new. This is made by Pentax and, although intended for use



Simon de Courcy Wheeler/equipment courtesy of R I Harding Ltd.



Howarth-Loomes Collection

Nikon adaptation *This custom built camera, made from two Nikon FMs, takes 16 stereo pairs on standard 35 mm format. Built by R I Harding, it retains most of the Nikon features as well as separate setting of shutter, aperture and focusing (right).*
A hand-held viewer, *for photographs or drawings, was once popular.*
Stereo projector *Many of these are now very scarce collectors' items*

Stitz stereo adapter *This can be used on lenses with focal length varying from 50 to 300 mm*

with Pentax standard lenses it can be used with other models with focal lengths between 40 mm and 55 mm if they have the same or (via adapter rings) similar filter sizes. In the past a number of other manufacturers made them, and it is still possible to pick them up secondhand. Leitz and Nikon made them for their rangefinder cameras, Zeiss offered one for the Contaflex cameras, and there was another model known as the Stereax. The better beamsplitters are those using prisms as they are more robust, though older types are prone to fungus.

Beamsplitters are relatively cheap, convenient and easy to find so they are favoured by many stereo enthusiasts. Unfortunately, they have a fixed separation and so are not really suitable for close-ups, and there is inevitably a small loss of quality when compared with the unadorned prime lens.

Both of these limitations are overcome by the rare and expensive twin lens adapters made for Leicas and Contaxes. The standard lens was replaced by a matched pair of shorter focus lenses in a common focusing mount—33 mm for Leicas, 35 mm for Contax. The separation is tiny, but this is ideal for close-up work. For pictures taken at normal distances, a prism device similar to a beamsplitter could be used. These adapters have one main drawback though—the two images on the film are not the same way round. One of them is transposed, so the film has to be cut up and remounted for use in a viewer.

Stereo cameras

Beamsplitters and stereo slides are undoubtedly the easiest and cheapest ways of taking stereo pictures. But a stereo camera offers much better quality. Several formats are available from large plate models right down to sub-miniature 16 mm types. This type of photography was very popular in the last century and so many of the cameras date from this time. Others date from the 1950s when there was a resurgence of interest in this type of work.

A large number of the older cameras are of use only as collectors' items as they used film sizes and types which are no longer available. It is sometimes possible to convert plate cameras to take cut film, but you have to cut the film yourself. The most usual sizes were 120 × 80 mm, 130 × 60 mm and 107 × 45 mm, though non-standard sizes also abound. Another major drawback with this type of equipment is that it is much sought after by collectors who do not use it, forcing prices to very high levels—at least as much as a new SLR and sometimes much higher.

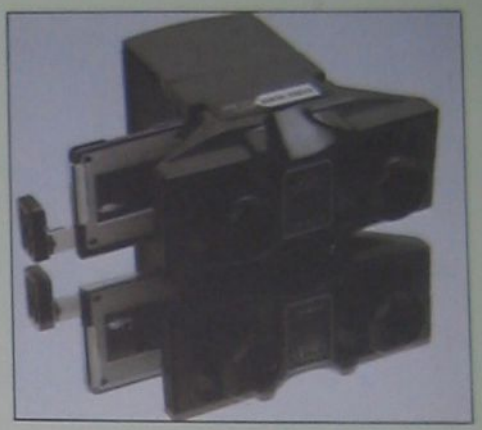
With a few exceptions, roll film stereo cameras are even more enthusiastically collected. The forerunner of the twin lens Rolleiflex was a stereo camera and

picture supplied by Nimslo

The Nimslo 3-D camera *gives a full colour stereo print that can be viewed directly, without a viewing aid*

fetches a small fortune. Roll film stereo formats are also unstandardized, but at least it is slightly easier to construct transparency viewers for roll film pictures than it is for plates. Even so, most users of both roll film and plate cameras tend to use prints. Late roll film cameras, such as the Duplex, are highly priced simply because there is little else on the market. 35 mm cameras are not (as yet) widely collected, but, once again, their prices are kept high by the laws of supply and demand. Although formats were never standardized only three are commonly encountered.

The first, and the nearest there is to a

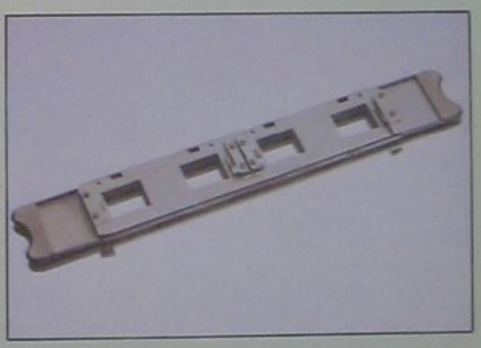


Stitz stereo viewer *Loaded with a 35 mm standard pair, this is a fixed focus viewer of Japanese make*

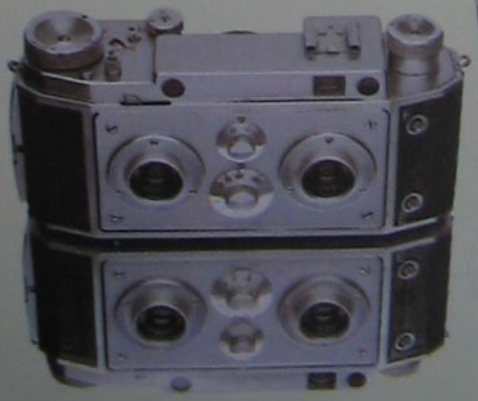
standard, gives stereo pairs where each picture is 23 × 24 mm. For efficient film use, and to obtain a suitable separation between the pictures, they are arranged so that each pair is separated by two frames in between them. Cutting and mounting the pictures can be quite tricky, though Kodak mount Kodachrome in 101 × 45 mm standard card mounts for a small additional fee. This format is found in a moderate number of cameras dating mostly from the 1950s. The Stereo Realist is the best known, but the Iloca Stereo, the Revere, the TDC Colorist, and even Kodak's Stereo 35 may be encountered from time to time.

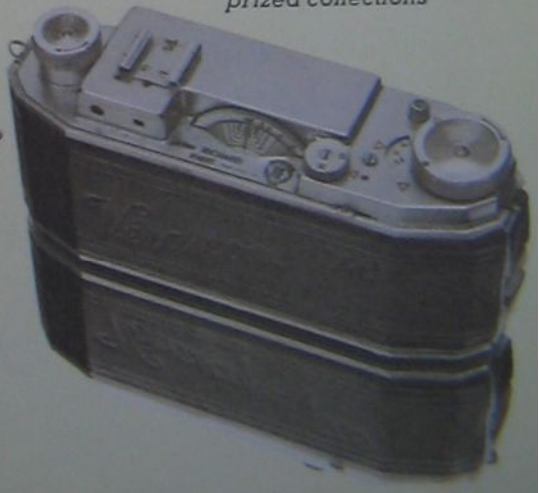
The second format, 24 × 30 mm, was essentially the preserve of the French

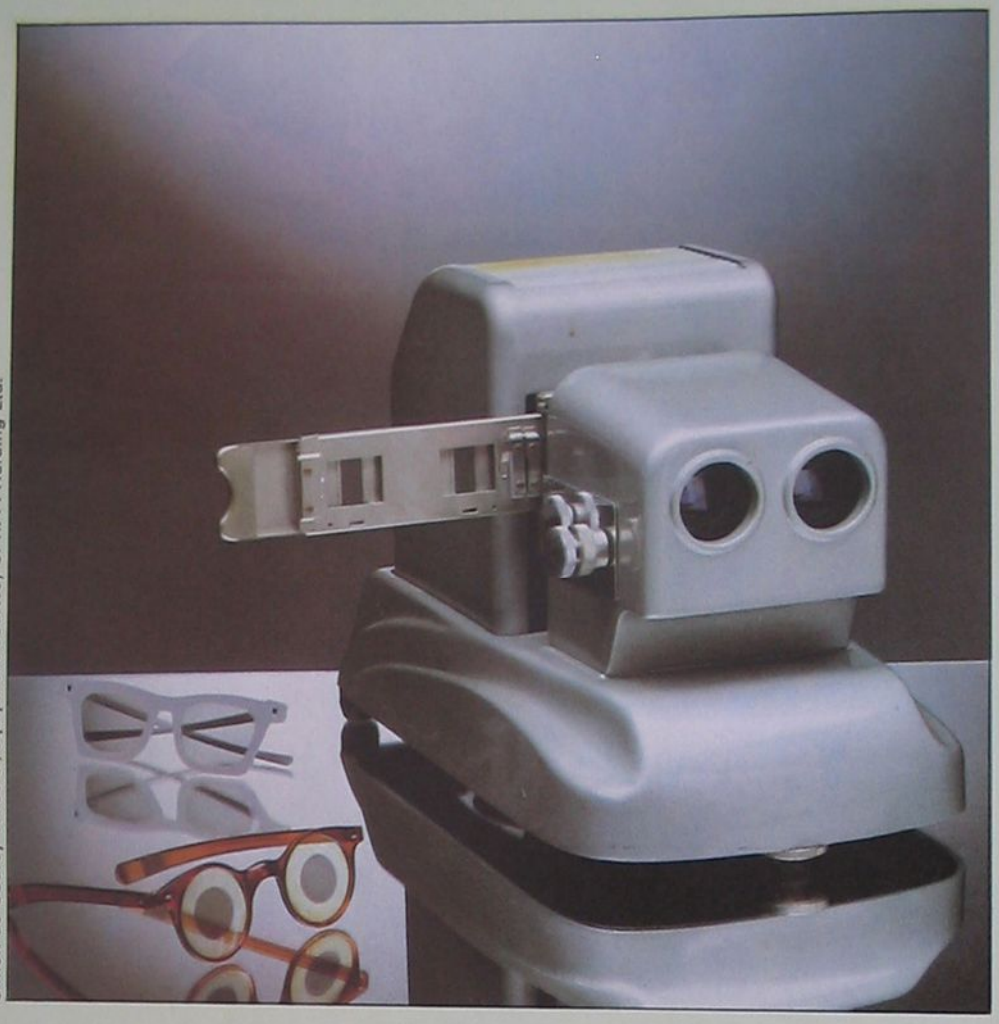
Simon de Courcy Wheeler/All equipment from R I Harding Ltd.



Slide holder *A sliding mechanism enables any of three formats to be selected for stereo projection.*
The Verascope F40 *(front and back views) is to be found mostly among prized collections*







Simon de Courcy Wheeler/equipment courtesy of R. I. Harding Ltd.

firm, Richard. Their Homeos (1925) was the first 35 mm production still camera of all, and the F40 (1954) was arguably the finest stereo camera ever made. The Verascope F40, as it is more often known, was stunningly expensive (about 50 per cent more than a contemporary Hasselblad) and is correspondingly rare. The same viewing equipment may be used for this format as for the 23 × 24 mm, though you have to mount it yourself (if you can get the mounts).

The third format is the tiny Viewmaster Personal Stereo Camera format with an image size of about 14 × 12 mm. In these unusual and rather eccentric cameras the film path is diagonal across the camera back, and the exposures are staggered in pairs.

One disadvantage with stereo photography is that the print or slide has to be viewed under special conditions. This is overcome in the Nimslo 3-D camera, though it is not widely available. The images from not two but four identical lenses are superimposed during the film processing stage and overlaid with a transparent film. This is embossed to form a large number of cylindrical lenses. These give the 3-D effect by enabling the images to be viewed separately, depending on the view angle.

Specially made equipment

If you want to use a stereo camera but dislike or cannot find secondhand items, it is possible to make your own, or have a conversion made to standard cameras.

Projector and glasses *The best arrangement for viewing slides is to project them through differently polarized screens, and view them through polarized spectacles.*

The Zeiss Ikon beamsplitter (*right*) *is a high quality instrument which was popular during the 1950s and 1960s. If you can get one today you should expect to pay about the cost of a mid range SLR, complete with lens and case.*

The Iloca stereo camera *dates from about the mid 1950s, and is now rare*

It is possible to buy pairs of matched lenses, complete with shutters, and mount them on the front of a Polaroid camera. The best type of camera to use is one of the larger peel-apart models, which give prints or negatives.

The other approach is to bolt two identical cameras together. This can be a complex and specialized job, and it is best done by experts. At least one company offers a camera body consisting of two Nikons joined together. However, this type of conversion is extremely expensive—as much as eight times the cost of a normal camera body—and lenses are extra. This presents another problem in that the two lenses must be of exactly the same focal length. Finding two lenses the same is not as easy as it may seem. Although a lens is stated to have a focal length of, say, 50 mm the actual length can be different by as much as five per cent. This means you need a certain amount of luck in your lens selection, although if you use lenses by one of the top manufacturers there are likely to be fewer problems.

Pentax beamsplitter *One of the few items of stereo equipment available new, is fitted with fixed mirrors*

Viewing the picture

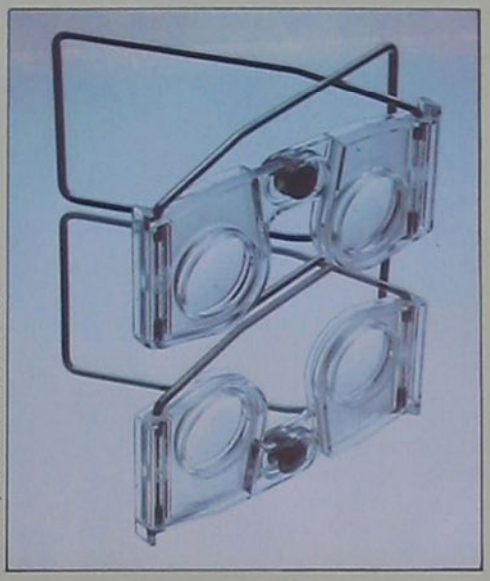
Whatever system you use for taking the pictures, you are likely to need some equipment for viewing the results. Some people can fuse a stereo pair without any accessories, but most require some sort of viewer.

The traditional approach uses prints mounted on a (surprisingly standardized) card and looked at with a hand-held or table viewer which contains two lenses similar to magnifying glasses. This method is simple and very effective. And getting the viewer is no problem—virtually any of those made in the last 200 years may be used (stereo drawings preceded stereo photography). Making and mounting the prints is not particularly difficult if you do it yourself. With trade processing, however, there can be difficulties. Few processing houses will print the odd shaped formats, and if they do, the resulting prints are likely to be somewhat arbitrarily and differently cropped.

Stereo projection is even more awkward. As with the camera lenses, the projector lenses must be precisely matched. And the difficulties of aligning twin projectors for one slide, let alone for a whole sequence, are so great that the only practical solution is to use a specially made stereo projector and stereo mounts—a strong argument for Kodachrome where the work of mounting the pictures is done for you.

Since the lefthand and righthand images are superimposed on the screen, you also need some way of distinguishing between them. The traditional method was to colour one green and the other red and to use spectacles with one lens of each colour. This system was used in cinemas showing stereo (3-D) movies.

Print viewer *The two stands are unfolded to support the twin lenses over the stereo print*



courtesy of Duval Studios Ltd.

A more satisfactory approach, and the only practical one with colour pictures, is to use polarizers on the projector lenses and polarizing spectacles (see page 1472). In order to maintain the polarization of the light it is essential that you have a metallic screen, and because quite a lot of light is lost in the polarizers, powerful lamps in the projectors and a good black-out are crucial requirements.

It was possible, during the 1950s, to obtain beamsplitters for use with movie cameras and projectors. You may still occasionally come across these and be tempted to use them. But they are not very successful with slide projection because of the registration and alignment problems involved.

Probably the most convenient and popular methods of viewing stereo pictures is to use individual viewers designed for slides. Although it is possible to buy viewers with built in light sources, simpler types using diffusers are perfectly adequate and have the advantage of being extremely portable. While it is possible to make these, or to adapt them from old stereoscopes, it is actually very easy to pick up new or secondhand models designed for 35 mm slides.

The Pentax beamsplitter is sold complete with a viewer, which although very simple is capable of excellent results. But, alternatively, it is still fairly easy to pick up secondhand models. As with beamsplitters the best types use prisms rather than mirrors. Another very useful feature is the facility to vary the separation between the eyepieces. The best example is the one made by Leitz. But there are many cheaper, plastic viewers, and the better ones (such as the Zeiss model) are nearly as good as the Leitz model.

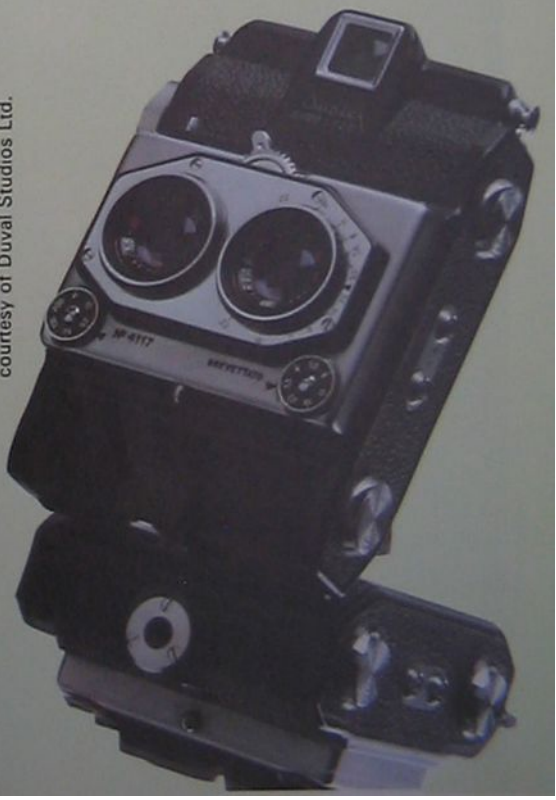
The main problem is, once again, one of non-standardization of equipment. But two types stand out as being most convenient. The first is the type designed to take a standard 5 × 5 cm slide mount with a split 35 mm frame, such as that given by a beamsplitter. GePe make a slide mount with a central division for this format. The second type is that which takes the standard Kodak stereo card mount.

Equipment sources

Apart from the Pentax outfit, you are unlikely to find any of this equipment in a normal camera shop. The best sources of stereo equipment are those shops catering for the collector, though this means that prices tend to be high. It is worth looking in junk shops and secondhand shops. Alternatively, most countries have groups of photographers who specialize in stereo work, and can direct you to the most likely sources of equipment.

There are very few shops specializing in stereo equipment. Probably the only dealer in new stereo cameras (adapted from standard models) is RI Harding & Co. Ltd, a repair specialist in London. And for stereo equipment generally, one of the best known dealers is Duval Studios Ltd, also in London. They stock used components, mounts, viewers and even projectors.

The Duplex 120 *is one of the more common stereo cameras. Its drawback is its very restricted lens separation*



courtesy of Duval Studios Ltd.

Stereo viewer *Probably the greatest choice in 3-D equipment is in viewers. This one has variable focus*

All photographs by Simon de Courcy Wheeler

Musical instruments

Musical instruments offer a vast variety of often beautiful shapes and textures. And looking for material in this comparatively specialized field can help develop your creative eye

When the subject range of your photography is very wide, it is very easy to take just the obvious, cliché shots, but one of the best ways of developing something different is to concentrate on a particular theme. By selecting a very small subject area, you can explore the possibilities in depth and begin to try a genuinely creative approach. A series of shots of musical instruments would be an ideal starting point.

There are as many ways of photographing musical instruments as there are different instruments, but there are two approaches which can be valuable: many musical instruments are beautiful or visually fascinating and they have tremendous potential as still life subjects; alternatively, you can try and photograph the instruments being played, concentrating on the relationship between musicians and their instruments.

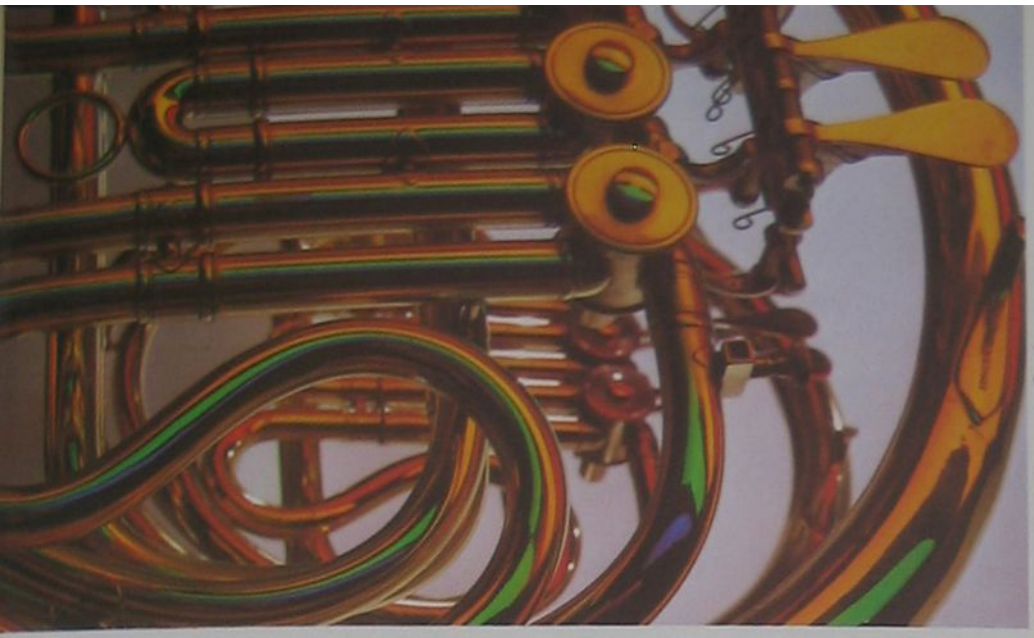
Some instruments are so visually interesting and attractive that there is no need to do anything elaborate to make an effective still life. A plain, unadorned background—colorama paper or carefully draped cloth—may be quite enough. You can then arrange the lighting to bring out certain qualities of the instrument. Warm, soft lighting may be best for bringing out the rich colour and grain of a violin, while you may need to add a bright, strong light to catch the shining metal of a brass instrument and give it sparkle. Remember, though, that correct colour balance is important—the colour of the light can affect the mood of the shot.

If you want a more elaborate shot, you could try setting the instrument in an arrangement of objects that conjure up all kinds of associations. With a violin, its bows, coiled strings, rosin, sheets of music and similar objects help to create the rather nostalgic atmosphere of 'fine things' often associated with the instrument. To complete the image they can be placed on a richly coloured wooden table or combined—either in the darkroom or by back projection—with an out of focus shot of an orchestra playing or an empty concert hall. With a saxophone, on the other hand, you could try to create a moody nightclub atmosphere: an electric guitar could be set against a dark background with flashing neon

Jack Tuley/Picturesport

Dumontier/Miss Photo

Saxophone keys *Where an instrument has interesting details like this, you can shoot close against a plain background*
Antique organ *Older instruments often show warm, mellow colours which you can use to give atmosphere to your shots*



Roberto Brosan/The Image Bank

French horn *Brass instruments usually have bright reflections, which you can enhance with careful lighting*

lights: and so on. You could even try to visually mimic the sound of the instrument—the high strident sound of a trumpet by a bright, high technology look, or a harp with waves on the beach.

Where you want to isolate the shape of the instrument alone, and leave texture out of your subject, then shooting in silhouette is another possibility. Many instruments have graceful, curved or slender shapes which can be emphasized best by strong backlighting—the harp is a good example of this.

Another possible approach is to set aside the context of the instrument, and concentrate on the wealth of interesting detail you can photograph. Almost all instruments offer such detail, and it is sometimes more effective to photograph only a small part of the instrument. The tuning pegs of a violin, the fretboard of a guitar might all make good subjects. But perhaps the most complex and fascinating detail you can readily see is on woodwind instruments—many have wonderfully intricate and delicate keys. On flutes, clarinets or bassoons these are usually of highly polished metal, and make excellent subjects for close-ups with their complex systems of levers and rods. This can be even more effective if the instrument is finely crafted—the silver keys stand out brightly against the ebony body.

By shooting close up you can also concentrate on the materials and texture of an instrument—old wooden instruments often have interesting wood grain which is a good subject in itself. This approach can help you to emphasize the antique, well-worn side of an old instrument. Old keyboard instruments are another possibility—their ivory keys also develop a distinctive grain with years of use, and they fade to an attractive golden colour.

As well as interesting details, instruments often have beautiful curves and shapes. If you prefer to concentrate on the 'pure' shape of the curve of the instrument, you can shoot in such a way as to create interesting abstracts or semi-abstract compositions.

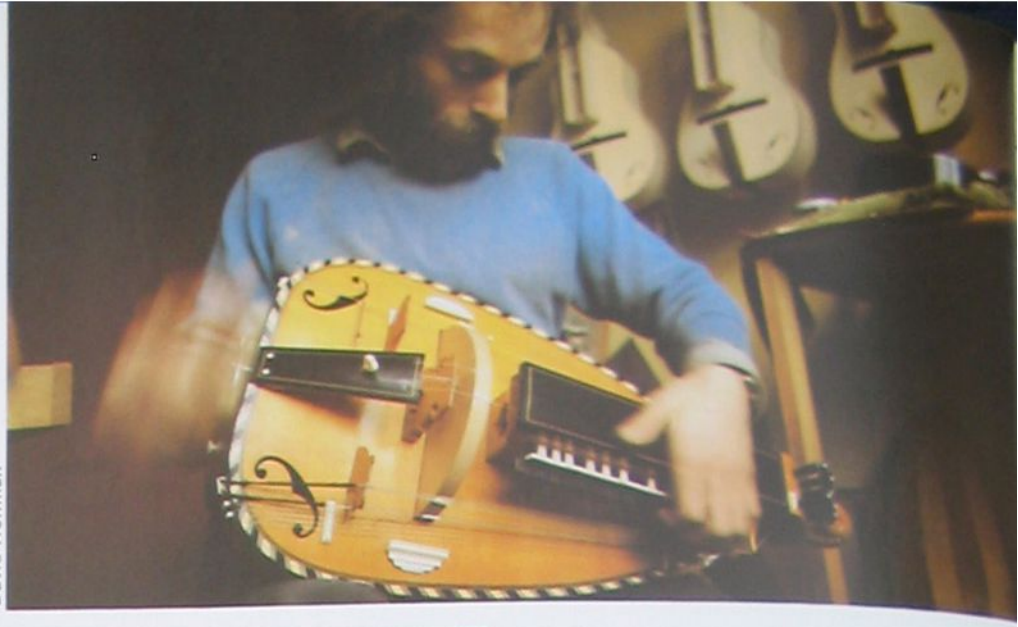
Many instruments lend themselves to this kind of treatment—but keyboard instruments are especially suitable—the large number of strings of these instruments give them a sweeping, curved shape unlike any other. By looking inside a piano, as well, you can discover more interesting designs—rows of metal strings over a golden coloured frame can make attractive compositions. Brass instruments, too, have polished bells which offer more possibilities—you might try concentrating on reflections in the metal, creating distorted images.

In the wings *When you are photographing performers, keep a look out for unusual or incongruous touches*

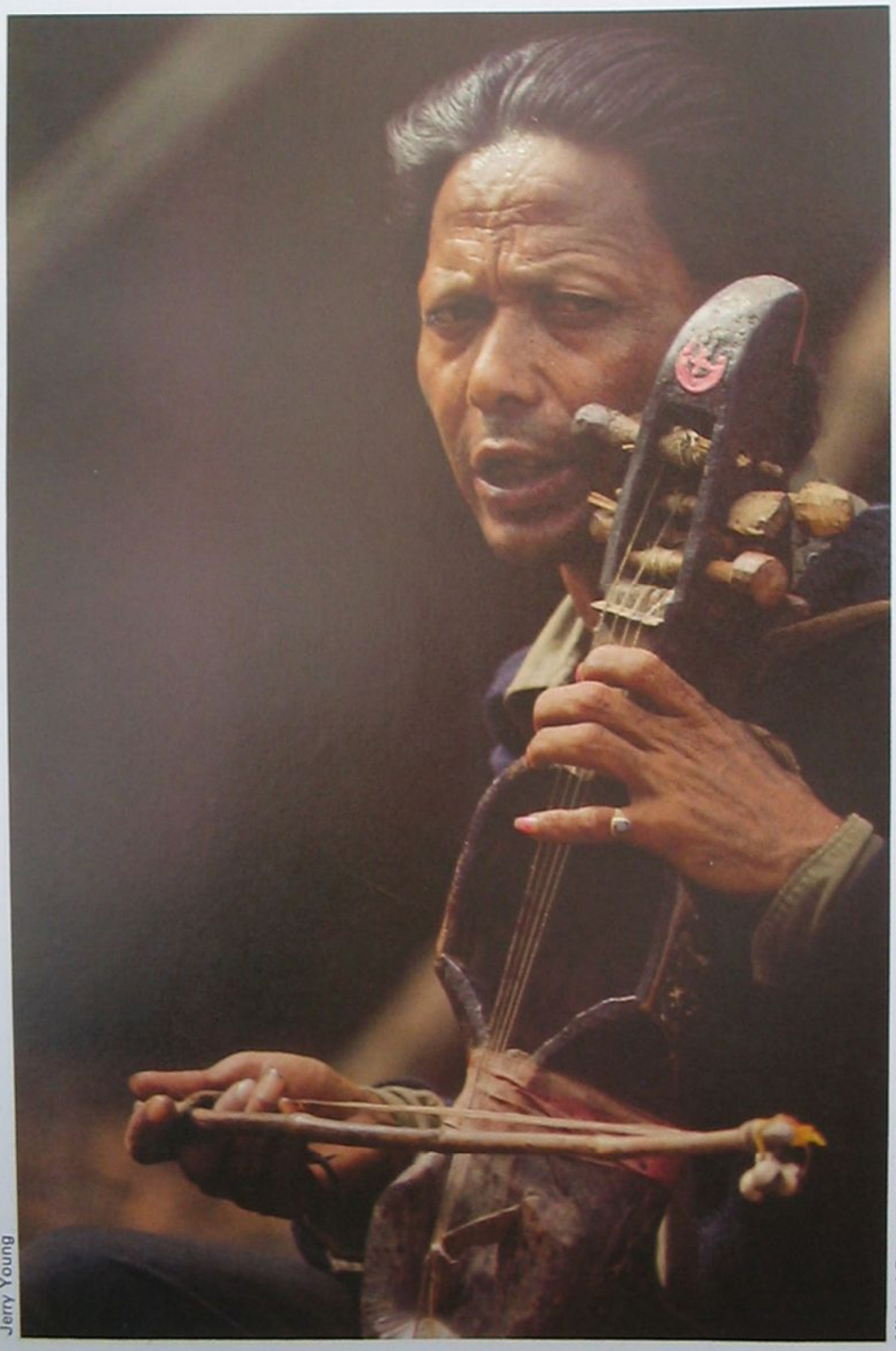
Susan Maeder

The strings of any instrument can be photographed in a variety of ways—a wide angle shot of guitar strings, shot horizontally so that they appear to be vanishing into the horizon might be effective.

Instruments are meant to be played, not simply looked at, however and it is worth arranging a session with a musician if you can. It is possible to take your camera along to a concert and shoot the musicians while they are playing. But this can distract the musician's attention or spoil people's enjoyment, and the technical difficulties are often severe. Home sessions are usually much more productive. The difficulty is in capturing some of the dynamics of playing in a still image. The obvious shot is one showing the musician playing his or her instrument but full length shots like this



David Hoffman



Jerry Young

Hurdy-gurdy *Craftsmen who build their own instruments make good subjects—note the blurred hands.* **Viol** *Street musicians are more accessible than concert performers.* **Piano** *A glimpse inside a keyboard instrument can reveal unexpectedly striking abstract designs.* **Pause for thought** *Photographs like this are effective because they capture mood when the subject is unselfconscious*

Michael Freeman/Bruce Coleman Ltd.

often look uninteresting and lifeless. To capture some of the movement in music, it is better to close in on certain features.

One of the most effective ways of showing an instrument being played is to concentrate on the musician's hands as they play. Whatever the instrument, the shape and texture of the musician's hands and the lines of the instrument can make an interesting contrast. With a slow shutter speed the moving hands should blur a little making the image less static. But you must shoot from a position that shows up the movement clearly. It is rarely effective, for instance, to photograph a pianist's hands from over his shoulder—try to get down low and close and shoot along the keyboard.

With wind instruments controlled blowing is even more important than the fingering and you can close in on the face or even just the mouth to capture this. The flute, for instance, requires a peculiar position of the player's lips, which changes as different notes are played. Trumpet players, too, often have interesting expressions as they play, and the effect is added to by puffed cheeks—you can often catch the expressions of concentration on the players' faces. A concert pianist, for instance, often has an expression of intense

Susan Maeder

concentration, while more popular musicians usually display more relaxed expressions. In all of these cases, bear in mind that your subject is the instrument so the performer should be photographed in such a way as to complement the instrument—the more action you put into your photographs, the more effective they are likely to be.

Instruments are inert objects and so work well in a still life context, but in the hands of a musician they spring to life. Music is vibrant and rhythmic and this is usually reflected by the player. You can exploit this to produce 'action' pictures which help relate the sounds of the instruments visually. You can use various photographic effects to help achieve this—for example, by using long or multiple exposures you can exaggerate a musician's natural movement to give a slightly blurred image. This type of shot may work well where you cannot close-frame your subject.

When the string section of an orchestra is playing, all the bows move simultaneously, sometimes in long, sweeping movements. One effective approach is to wait until they are all vertical, and shoot from a distance with a telephoto lens, crowding all the bows into compressed perspective. You might also try a slow shutter speed, or even a multiple exposure, to enhance this effect.

Perhaps the most dramatically moving musical subject is a drummer—here too you can apply the long exposure or multiple exposure technique to advantage, as the drummer moves the sticks in arcs across the drums.

Another way of photographing an instrument and musician is to try and create a parallel between the two. A stout saxophonist in full cry, for example, photographed from the side, can convey a strong impression of the relationship between player and instrument.

When shooting this type of photograph, you should pay special attention to composition to achieve your desired effect. The musician's build, for instance, can sometimes suggest the tone of the instrument—a thin violinist suggests the piercing notes produced. And if the musician's body is slightly bent, this effect is further emphasized.

Music consists of vibrations—you cannot photograph these, but you can attempt to simulate them on some instruments. On bass string instruments of any kind, the strings vibrate loosely enough for them to appear as a blur in any photograph. Otherwise, long exposures or multiple exposures can help create the illusion of vibration—a slight but noticeable blur is sufficient to produce this.

Whatever your approach, photographing musical instruments can be very rewarding, if you take the time to work for a given effect. This kind of subject puts your ingenuity and creativity to the test—it is very satisfying to make an expressive photograph out of what is, essentially, a lifeless object.

Horst Munzig/Susan Griggs Agency

Bass bell *Large brass instruments might show interesting reflections—here, the image resembles that of a fisheye lens*

John G. Ross/Robert Harding Associates

Violins *Classic subjects like this make effective shots—note how lighting here brings out texture in the wood grain*

What went wrong?

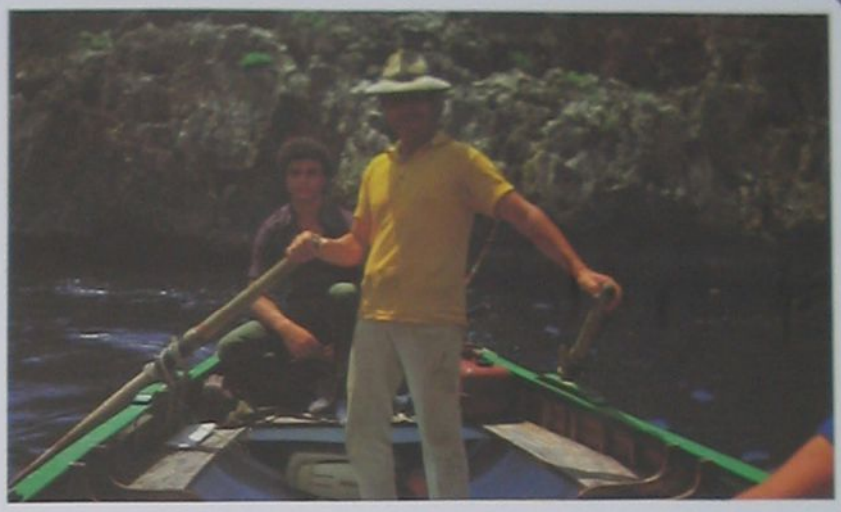
Candid criticism

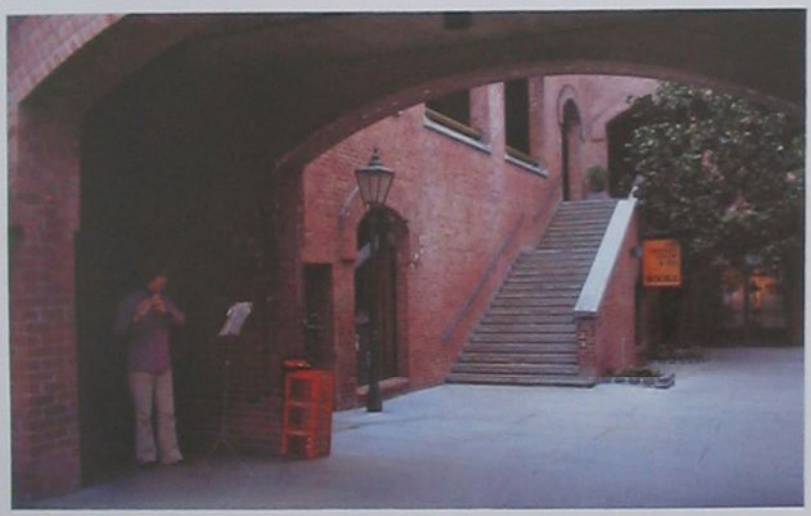
Three candid shots taken on holiday—and Sergio Dorantes gives his judgement on their strengths and their weaknesses

People are undoutedly the most photographed subjects in world. Capturing in just a fleeting moment a reaction, a gesture or a pose of a human being has always been a challenge to photographers.

This picture has several ingredients which at first glance make it an appealing one. The subject is clear; he evidently has a strong character which comes across strongly in a photograph; and the exposure is good. The structure of the picture leads the viewer straight to the subject, so there is an immediate delivery of its content.

Unfortunately, there is one defect which becomes obvious when you look closely—the boatman's eyes are closed. This one factor spoils the shot, as we expect such a character to be looking at us—the eyes are the focal point of one's attention. The only way to make the most of such a chance as this is to take several shots rather than just one: then any such faults, which you probably would not notice in the split second that the viewfinder blacks out, are less likely to be present.





One useful technique when taking pictures is to place your subject within a frame. This approach has been used here by the photographer, but although the result is very attractive and atmospheric, judged critically it is rather unsuccessful. Placing the street musician at the left edge of the shot attracts attention, but then the framing of the staircase of the building becomes a disturbing element in the composition. It becomes a photograph of the building, with the figure as an incidental feature, rather than a candid.

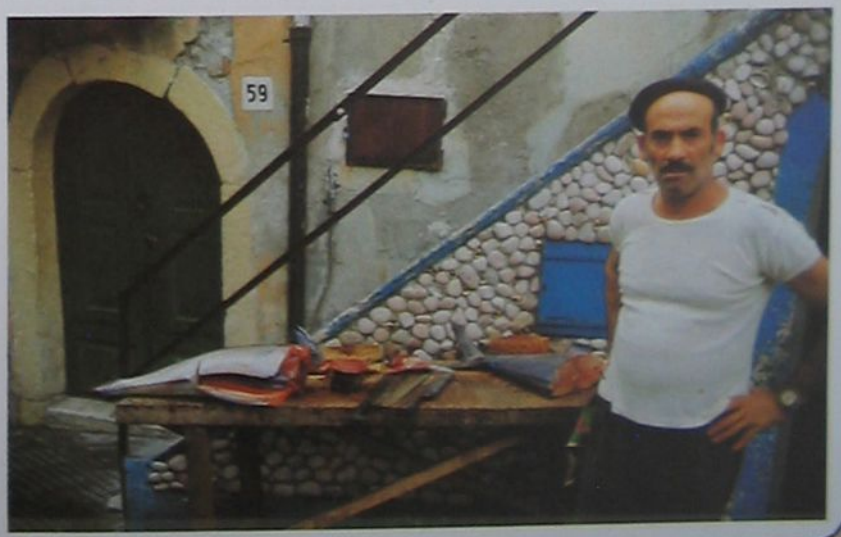
In candids, people should be the main subject of the photograph. Therefore, the photographer should emphasize the characteristics of the person being photographed. In this example, getting closer to the musician could have produced a true candid picture, showing the concentration of the musician while playing his instrument. It is always worth thinking, before taking a photograph, which elements are going to be made prominent and then arranging the composition so that there is no competition between the various features.

This photograph has elements which make it an interesting image. The surroundings successfully add information about the occupation and lifestyle of the subject. This kind of picture is difficult to take as the photographer should not interfere with the activities of the subject—if this happens the picture will lose its candid and spontaneous quality.

The general structure of the picture is good, with the main features balanced through the picture: the Sicilian fish seller, the goods on display and the doorway on the left which partly balances the figure and partly serves to lend atmosphere to the shot. But to make the picture a winner, the figure should be fully included in the frame—his arm is cut off by the edge of the picture. Furthermore, he is slightly out of focus.

If the photographer had wished to make the fish the subject, rather than the fish seller, then a close-up of the fish would have been more successful. But as the vendor is there, it is more likely that he is the subject, in which case he should be critically in focus.

The picture was taken with a 50 mm f/1.7 lens



Assignment

Food for thought

To make almost any sort of food look really appealing in a photograph, the photographer has to exercise as many skills in the kitchen as in the studio. Roger Phillips shows some of the tricks involved

Photographing food is a highly specialized field that demands a combination of the patience and technical expertise of still life photography with a knowledge of food itself. Unlike most still life subjects, food shots have to be done as soon as the menu has been prepared—the photographer is not afforded the luxury of hours spent tending to small details. There are many ways of making food look especially inviting, and as these mainly come from experience we asked professional Roger Phillips to show us some of the tricks of his trade.

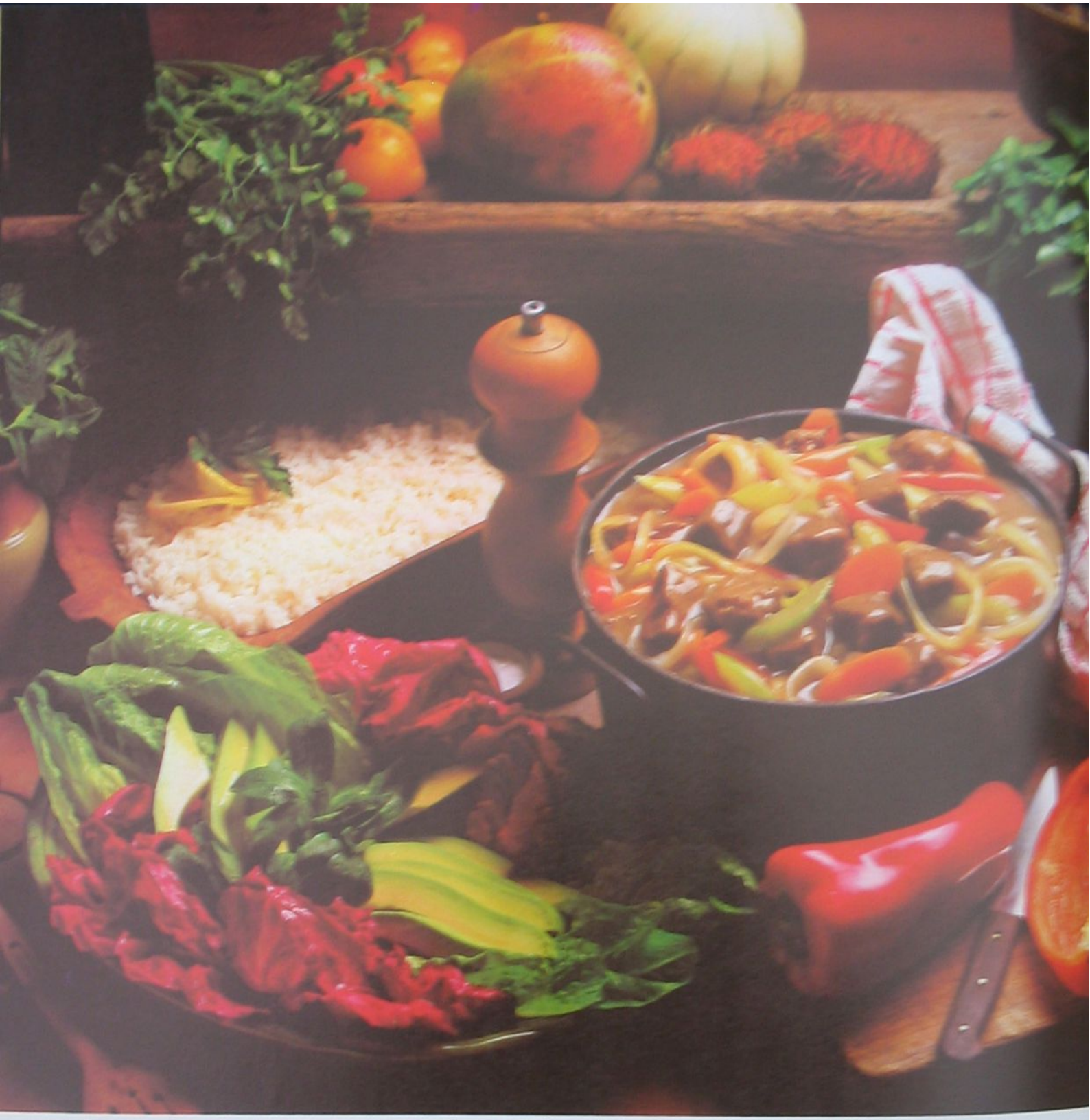
Food is chosen with great care—only perfect items are used—anything that is not perfect is discarded. The food is then cooked according to the preplanned menu. However, cooking for photography is quite different to cooking for the table and many things are prepared purely for their visual rather than immediate gastronomic appeal.

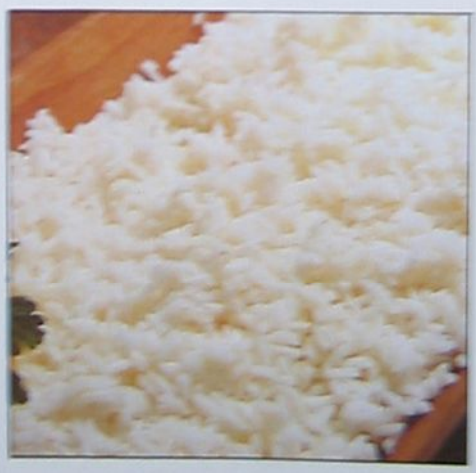
The basic set-up which Roger decided upon was one that almost anyone could attempt. As Roger pointed out, 'Food photography has advantages for the amateur because all shots are taken at close range and you don't need a huge studio—a table top is sufficient.'

Appropriate props are selected to tie in with the theme of the meal—the choice of pots, pans, bowls and kitchen

Roger Phillips

Table-top studio *Roger took a few shots with his Hasselblad to show the working area and some of the props that were used. After assembling the basic requirements—table to work on, tiles to make an interesting surface on which to place the food and a makeshift shelf to put in the background—they were laid out roughly so that they occupied the whole picture area. The approximate position of the large flash head can also be seen in the first shot (top left). Roger deliberately selected wood of a rough texture and attractive containers—all to help create atmosphere and context. When planning the set, he likes to arrange things so that some props disappear out of the edge of the frame, giving the impression that there is more going on outside the picture. For this particular shot, he placed several extra objects which were not directly connected with the food around the main subject. These all lend the picture a country kitchen feel.*





The finished shot *As soon as the food was placed on the table and the ice cream removed from the freezer, Roger had to shoot quickly. Since everything was rehearsed beforehand, the lighting was already angled correctly and he knew exactly where everything was to be placed. Semi-backlighting accentuated the textures and the rich colours*

Rice *These two shots of the rice show the effects of different lighting arrangements. By adjusting the flash head so it was almost overhead (left), the modelling effect was lost and the rice appeared as a featureless mass. A lower angle (right) corrected this*

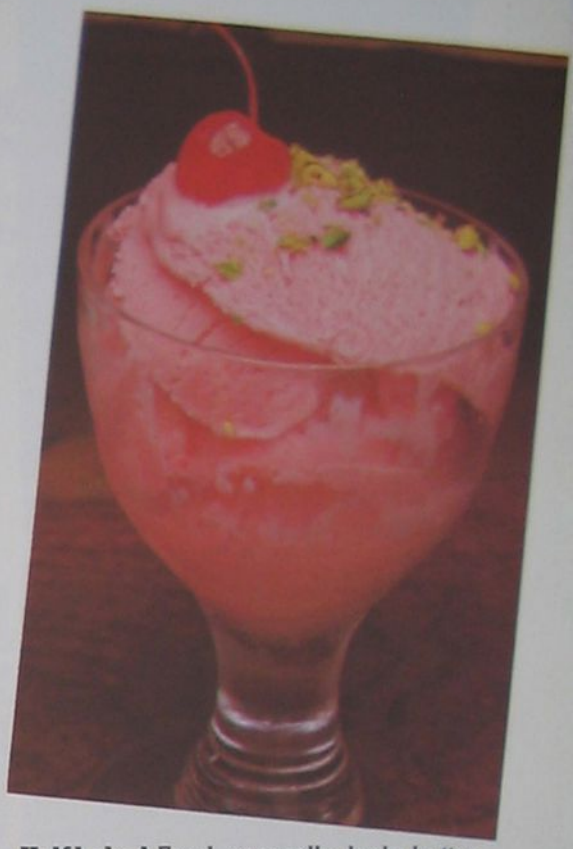
Roger Phillips

utensils plays an important part in the appearance of the food and the success of the shot. These things can be laid out first, before the food arrives—'The food has to be photographed as soon as it is cooked so I always do a mock-up arrangement beforehand, then I have the composition and lighting fairly well organized when the food is brought in.'

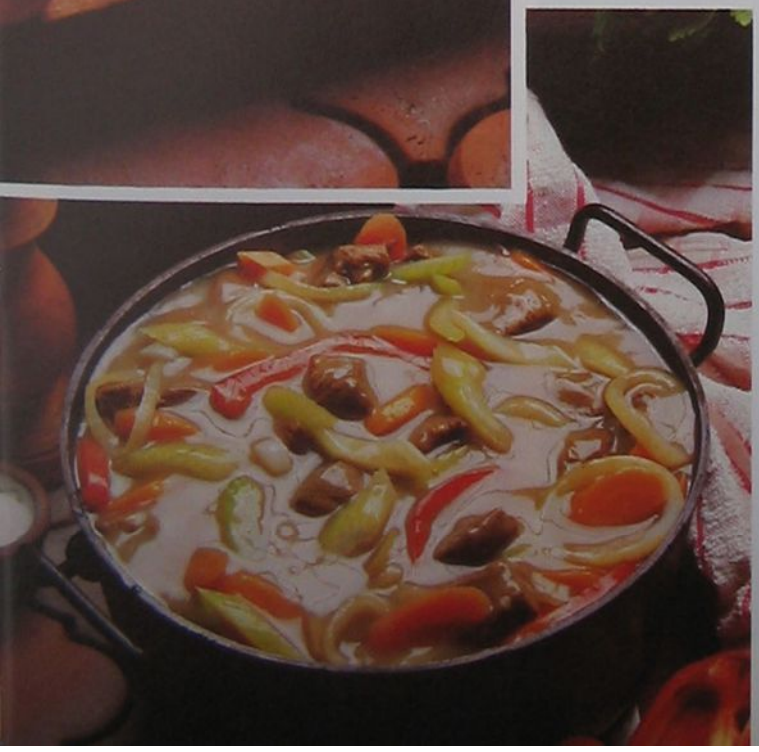
Roger's lighting system is a formidable stack of equipment delivering up to 13,000 joules of power—probably 200 times the power of average hand flash guns. This power allows him to stop down the lens on his 5 × 4 inch Sinar to *f*/64. Roger always works at this aperture to give him maximum depth of field at close distances. For the amateur, though, shooting on 35 mm equipment, a couple of hand-held flashguns are sufficient.

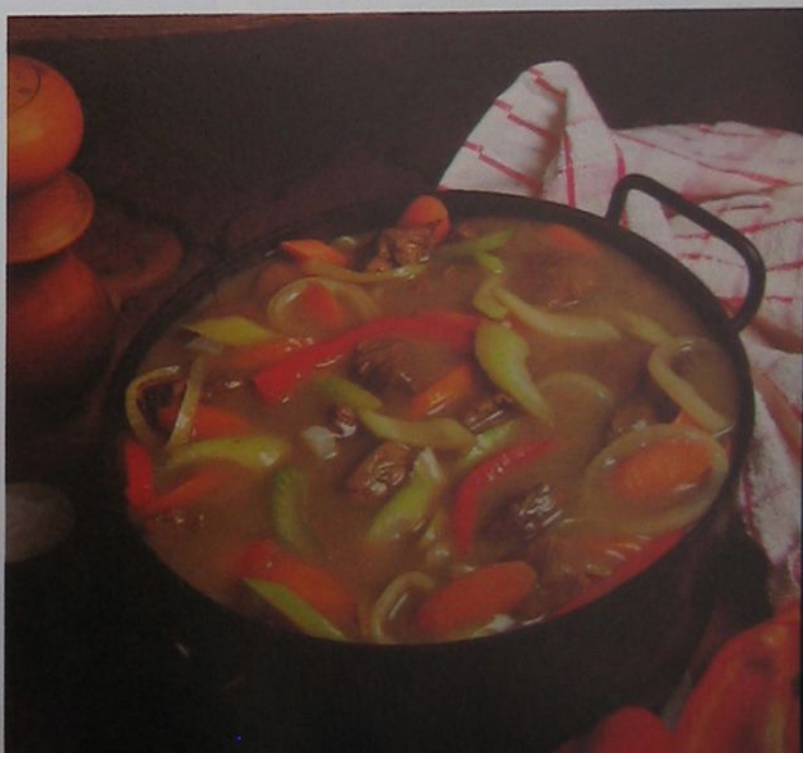
The large flash head is positioned above the subject and angled slightly toward the camera to give a semi backlit effect. The angle of the light is altered by trial and error to produce just the right modelling effect—the more acute the angle, the higher the contrast and the more saturated the colours. Roger always shoots on Ektachrome 64 sheet film, bracketing the film speed a half stop either way. The exposure is calculated by a flashmeter and the power output is adjusted accordingly.

When calculating the exposure, Roger was careful to take two separate readings. By angling the probe of the flash meter towards the light he obtained a reading for the highlights but by pointing the meter away from the flash he obtained a reading for the shadows. By bisecting the angle between the two positions, an average reading was indicated. This gives a guide to the exposure needed but the final decision is made according to the effect needed. The long extension of the bellows of his Sinar also calls for a further increase in power—after measuring the length of the extension, Roger found that the light loss amounted to one whole stop.



Half baked *Food, generally, looks better if it is not fully cooked. The rice, for example, was only half cooked and then rinsed and tossed in oil. The casserole was diluted with cold water to prevent a skin forming, while the vegetables, prepared separately to preserve their form and colours, were introduced later. Salads and green vegetables were sprayed with water to add to their fresh appearance. Ice cream must be photographed immediately it leaves the freezer. Liquids, especially those containing oils, may create harsh reflections if lit from directly overhead. This can be reduced by moving a diffused flash behind the set*





Pictures underwater

Taking the plunge into underwater photography demands more than simply diving in with a waterproof camera. For the best results you will need to employ special techniques in the unfamiliar conditions

Most of us think of the sea as a backdrop for photographs of harbours, boats and beaches. But the surface of the sea is like a curtain that conceals another world—a world where the photographer is weightless, and can move easily in all directions.

Snorkel and scuba diving provide the key to this hidden world, and if you are learning to skindive, you may want to take pictures of what you see underwater. The article on page 1386 describes the special cameras and waterproof housings that make this a practical proposition, but underwater photography is not just a matter of picking up a suitable camera, and diving head-first into the water. There is a lot more to it than that.

Flip Schulke/Seaphot/Planet Earth Pictures

The basic approach *You can get very interesting pictures with nothing more than a snorkel and a simple underwater camera and flashgun*

Safety first *Diving equipment should always be checked before use. It is dangerous to cut corners for the sake of a few extra minutes*

Diving and the photographer

The most important point to remember when taking photographs underwater is that you are a diver first, and a photographer second—safety must have priority over picture taking.

Before you plunge into the water, make sure that you know what you are doing. Despite the apparent simplicity of the apparatus, even snorkel diving can be highly dangerous if you do not know how to control your breathing. If you plan to go diving while on holiday, you may find it useful to take a short course at a local swimming pool before you leave home. This can save you valuable time when you arrive at the holiday resort.

For the diver—and the photographer—the sea can be thought of as three distinct layers. The first extends about five metres down from the surface, and in this region you can dive using only a face mask and snorkel. In this layer too, photography is comparatively simple, because daylight penetrates the water, providing sufficient natural illumination for taking pictures, and pressure is not great, so that even simple underwater cameras can be used. The plastic bag shown on page 1388 is quite adequate at these depths.

The next layer extends from five metres down to about 50 metres. Scuba gear—Self Contained Underwater Breathing Apparatus—is essential. And because much less sunlight penetrates this far, artificial light is also needed for photography. The water pressure increases at greater depths, and you must take great care to ensure that water does not seep into your camera. Very sophisticated housings are needed when you dive to the limits of scuba apparatus.

The remainder of the oceans—deeper than 50 m—are strictly out of bounds for the amateur diver. Very elaborate equipment is needed both for photography, and for survival. The water above filters out almost all light, and generates enormous pressures that can force moisture through even the tiniest opening.

These restrictions on depth may seem discouraging, but the most interesting and attractive region of the sea, as far as the photographer is concerned, is within about ten metres of the surface. Here the ample daylight nourishes a great variety of fish and plant life, and in fact, you do not even need to dive to take pictures near the surface—in shallow seas, it may be enough to just splash along the surface with face-mask and camera. This is particularly true in warm waters where coral reefs lie only a metre or two down.

Taking the plunge

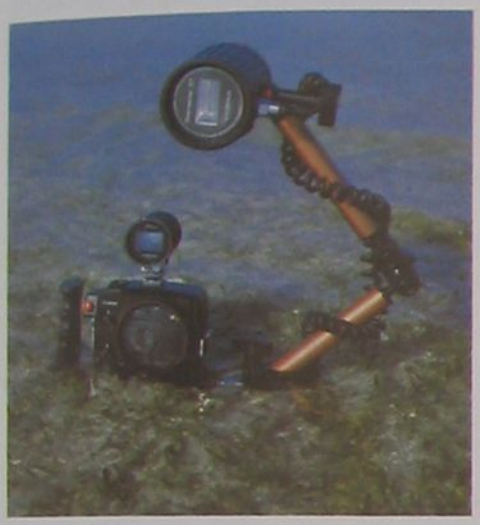
Besides the obvious problems of keeping the water out of your camera, there are other difficulties involved in taking photographs underwater. The most important of these is refraction.

Because light travels more slowly in water than it does in air, all objects underwater look closer through the flat glass of the face mask than they really are. This is important because it increases the effective focal length of the camera lens by 25 per cent. This means that the angle of view of the lens is reduced when

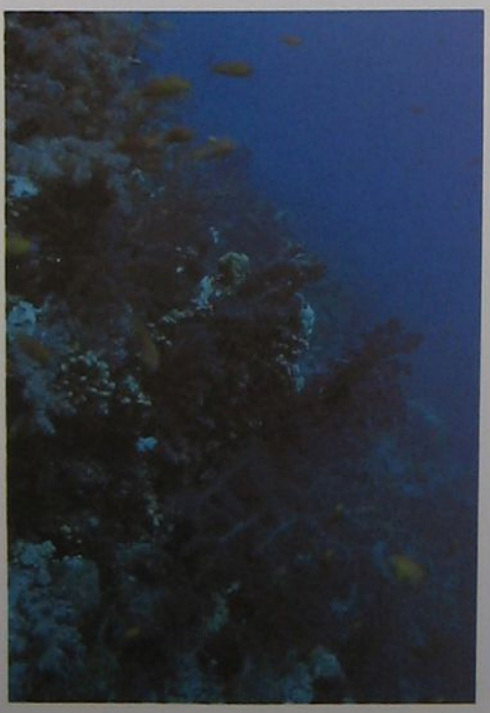
it is used underwater, and the depth of field is reduced.

Surprisingly, this does not create focusing problems. With an SLR in an underwater housing, the camera can be focused visually using the focusing screen (though this is usually possible only if a speedfinder or action-finder is fitted). You simply focus the camera on the subject as you would on land, even though everything seems nearer.

With non-reflex cameras, however, you must focus largely by guesswork. If you are using a conventional viewfinder camera in an underwater housing, you can use the focusing scale just as you would on land, but you must estimate how far away the subject appears to be



Subaqua flash *An underwater flashgun, like the one above, is an extremely useful item. Water absorbs much of the daylight so that the naturally lit scene is often dim and lacking in colour (below right). Using flash gives a better level of illumination and greatly improves the colour rendition of the scene (below left)*



Altered size *The two pictures (right) were taken with the same lens at the same distance, but in air and water. The subject appears larger in the lower shot because of the refracting effect of the water*

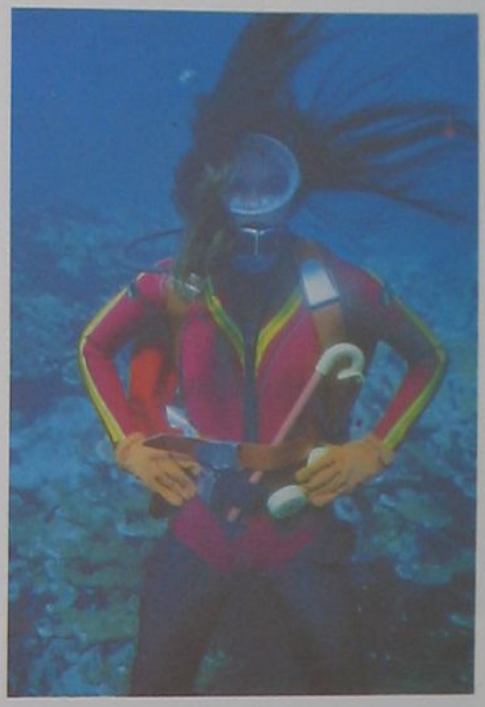
and set the *apparent* distance, not the *actual* distance as it would be measured with a tape or a rule. The same is true of underwater, or amphibious cameras. In all cases, the focusing scale on such cameras is marked with the apparent distance from camera to subject, rather than the actual distance.

The narrower angle of view and reduced depth of field present more difficult problems. Seawater is often very murky, and you cannot usually see farther than 10–20 m. The majority of underwater photographs are taken at distances of less than three metres, so the angle of view becomes of crucial importance.

A lens for a 35 mm camera which has a focal length of 35 mm in air becomes the equivalent of a 47 mm when used underwater, and if you use it to take a full length picture of another diver, you must be about four metres from your subject. At this distance, the dirt suspended in the water between you and the other diver is often sufficient to reduce definition and contrast considerably, and there is no alternative but to move in closer to get a sharper result.

Naturally, this means that less of the subject appears in the picture, unless you use a wide angle lens. With a simple fixed lens amphibious camera, this is impossible, and such cameras are of limited use for this very reason. With a Nikonos camera, or an SLR in an underwater housing, you can fit a lens which has a shorter focal length, and takes in more of the subject.

An alternative to changing the lens is



Flip Schulke/Seaphot/Planet Earth Pictures

to use a dome port over the front of an underwater housing. This is a large, deeply curved front glass, and it corrects for the refraction caused by the water. It has to be used with a supplementary close-up lens fitted to the principal camera lens within the housing, —without this, there is a considerable focus shift. Even with a correction lens, there is usually some change in the point of sharp focus, and the focusing scale on the camera must be recalibrated by experiment.

Colour and exposure

Not only does water refract light to a greater extent than air, but it also absorbs it. Some of the daylight that falls on the surface of the sea is reflected, and never penetrates the water, and the light that does penetrate becomes dimmer at increasing depths. Even in quite clear, shallow water—five to ten metres down —you must give one or two stops more exposure than you would normally give on the surface.

If your camera has a built-in meter,

exposure measurement is unlikely to be a problem, but for other cameras, you must use either a separate hand-held meter in an underwater housing, or rely on guesswork. Since the cost of a meter and housing is quite high, guesswork is frequently the only practical alternative.

If you are used to relying on a light meter, this may seem a haphazard technique, but it is usually sufficiently accurate for negative films. Transparency film has very limited exposure latitude, and you should bracket exposures heavily if you are guessing the settings for colour slides.

You can quickly increase the accuracy of your exposure estimates if you arrange to have film processed soon after exposure. This way you can shoot a test roll underwater, and judge from the results whether your estimates were sufficiently precise. This procedure also serves to check whether your equipment is operating correctly. If you are away from home, you may be able to find a local processing laboratory, or simply develop the film yourself using the makeshift technique described on page 1422.

Light absorbtion by water is not even across the spectrum, but is differential—red light, for example, is absorbed more strongly than blue. Despite the fact that a glass of seawater looks clear, it actually has a pale blue tinge. While this is unnoticeable in normal conditions, it is of increasing importance as light travels through greater and greater depths of water. Its effect is to gradually and progressively filter out all colours of light except blue as the diver swims down from the surface of the sea.

This means that as you go deeper, there is a progressively stronger blue cast, and yellows and reds become weak. Even in clear water, red light is missing from the spectrum by the time the diver has descended to a depth of five metres, and red objects appear dark grey or black at these depth and below. At 20 m only blue light remains, and photographs taken at this depth by available light appear monochromatic—just blue and black.

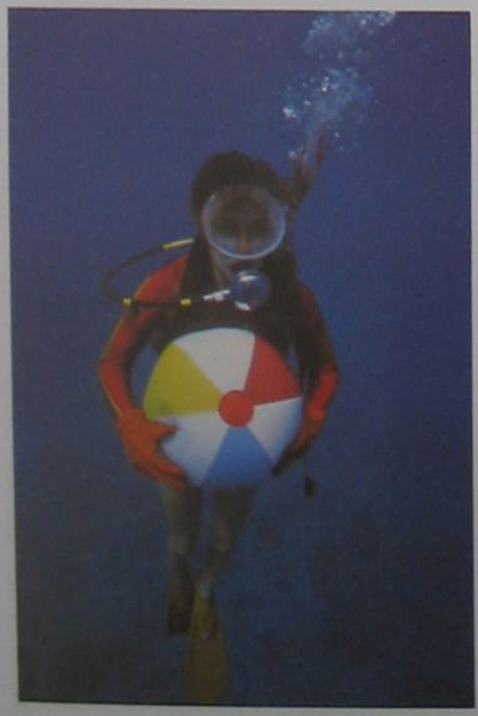
Distance density *The further you are from the subject the lower the contrast becomes, as can be seen from these shots taken at distances of 1, 2 and 7 metres. Many sub aqua photographers use wide angle lenses as these allow them to get close to the subject and still show all of it*

The blue-black tones of a colour picture taken underwater cannot be improved by filtration, because a filter can only remove colours, not replace them. The only way to photograph submarine objects in their true colours is to use flash—either electronic or bulb.

Bulb flash has a number of advantages underwater—it is compact, cheap to buy, and relatively powerful, but electronic flash is undoubtedly more convenient. You can buy special underwater units, or put your own land-flash into a waterproof housing. Whichever system you opt for, the principles are the same. The most important point is that the axis of the flashgun must be as far from the camera as possible, to avoid *backscatter*. This is the reflection of light back to the camera from suspended particles in the water, and it shows up on film as tiny white dots across the whole frame. Good quality underwater flashes have large connecting bars to move them far out from the camera to avoid this effect, and the tiny built-in flashes found on compact amphibious cameras are all but useless, as they are too close to the lens.

Treat with caution the guide number of any flash unit that you use underwater. Just as the water soaks up sunlight, so it reduces the power of a flash. Even the most powerful flash unit is useless at distances over four or five metres because the light from the flash has to travel twice this far—once to the subject, then back to the camera.

If you are using flash, exposure testing is especially important, because your initial estimate of the power of the flash



Colour and depth *The deeper you go the more blue the light becomes, due to absorption by the water. At a depth of three metres (left) colour saturation is still reasonable. But at six metres (middle) the yellows and reds are very weak, and at 12 metres the blue cast is so pronounced that the picture is almost monochromatic (right)*

unit will probably be too optimistic. Once again, the only answer is to process films on the spot, and compare the negatives with the exposure settings that you used underwater—bracket generously to include the correct exposure.

Underwater technique

Photography underwater is so different from photography on land, that even things that you normally take for granted have to be thought out carefully. The only way of becoming really skilled is to actually practice the techniques described here, until they become second nature. There are, however, a few general points that may help to safeguard your equipment, and improve your pictures.

Check the O-rings Almost all subaqua equipment is sealed with rubber rings, which rest in a shallow groove. These rings, and the grooves, must be kept perfectly clean and well greased. A small grain of sand is enough to break the seal, and flood the camera.

Condensation If you are diving in cold water, the inside of a housing can quickly mist up. A bag of silica gel packed inside with the camera can cure this.

Move in close Distant scenes are usually disappointing. Use a wide angle lens if you can, or else just avoid subjects which are more than three metres away.

Think about backgrounds In shallow water, the surface of the sea makes a splendid background, and the sun shining through the water can be used to backlight other divers—this works particularly well with fill-in flash.

Take your time It is easy to run through a roll of film in a matter of minutes, particularly with 126, or 110, both of which have a maximum of 20 frames. It is impossible to load film underwater, so when you run out, you will not be able to take any more pictures without surfacing, rinsing the camera in fresh water, and reloading—a time-consuming routine.

Do not trust the viewfinder The simple frame finders used on underwater cameras are frequently innaccurate. A test roll of film helps you find out how much of the subject is really appearing on film.

Flash backscatter *Using flash in water is very different from using it in air. The light is picked up and reflected by particles suspended in the water (above). This is an effect known as backscatter, and the result is low contrast (below). One way to overcome this problem is to move the flash well away from the camera*

Flip Schulke Seaphot/Planet Earth Pictures

Equipment file

Buying an old SLR

The familiar modern SLR is the product of over 50 years of development. But many of its forerunners are highly prized collectors' items and, as precision instruments, some have never been bettered

Before World War 2, there were only a few isolated models of single lens reflex cameras and even these barely resembled the modern SLR. The Sport appeared in Russia in 1935, but it was little seen outside its native land. The Kine Exakta appeared in 1936, but it did not have a pentaprism and the photographers had to work with a laterally reversed image (like a TLR) in a tiny waist-level viewfinder. The mirror did not spring back immediately after exposure like modern SLRs, and the screen blanked out until the camera was wound on again. Its rather eccentric controls also told against it. The only other pre-war SLR was the 1938 Praktiflex, which suffered from similar drawbacks to the Exakta and was much less versatile.

Considerable research was done in Germany during the war years, but because of the partition of Germany the result did not become immediately available. The first fairly modern production SLR was the Hungarian Gamma Duflex (1947) which had an instant-return mirror, eye level viewing (although still laterally reversed and not covering the whole of the focusing screen), and internal linkage for a fully automatic diaphragm.

Although there were a couple of earlier prototypes, the Contax S is usually hailed as the first modern SLR. It had a pentaprism, but the mirror was still non-instant-return, and the lenses had manual diaphragms, which meant that the lens either had to be stopped down to the correct aperture after focusing or it had to be focused at the correct aperture.

The instant return mirror—or 'flipping mirror' as it was endearingly called in early Japanese literature—was introduced by Asahi Optical in their 1954 Asahiflex IIB, but this camera had only a waist-level finder. Lenses were preset, so that they could be flicked down to the chosen aperture quickly and easily, but there was still no diaphragm automation. In 1955, the Praktina FX had a lens which *stopped down* automatically, but still had to be wound open to full aperture with a separate cocking lever: the mirror was not instant-return, though an add-on spring-powered auto-winder made it effectively so. The 1957 FXIIa incorporated full internal diaphragm automation, though Exakta introduced an external linkage model prior to this.

It was not until the late 1950s, though, that everything came together—pentaprism, instant return mirror, internal full diaphragm automation—and the first classic modern SLR was probably the Nikon F (1959). Thus, the familiar SLR is little more than 20 years old.

One particular drawback of the early SLR was the need for retrofocus lens designs (see page 1456). Because of the mirror, a non-retrofocus wide angle lens could not be set close enough to the film plane, and designing a wide angle lens for an SLR was very complicated.

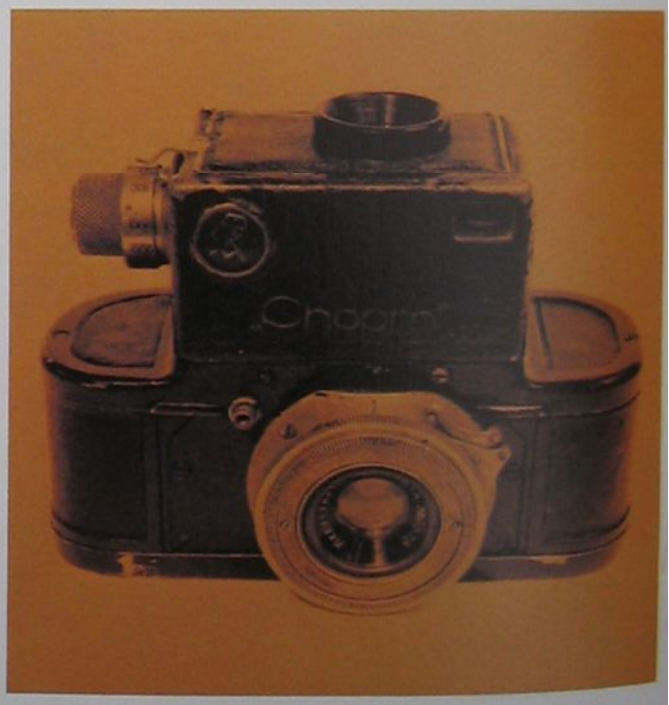
The first wide angles for an SLR were 35 mm lenses made by Angenieux and Voigtlander which appeared in 1950. Thereafter, development was slow—even in the mid-1960s, 28 mm was usually the widest available—24 mm was very rare indeed. With the few lenses wider than this, the mirror could be locked up out of the way, and the camera used as a non-reflex.

Colin Glanfield/Vintage Cameras Ltd.

Russian CNOPM or Sport (*right*) *Now extremely rare, this 1935 camera has a focal plane shutter, fixed eyepiece reflex viewing and an Industar 50 mm lens in an interchangeable mount. It gave very good results*

The Pentacon FM (*above*) *ranks highly as one of the world's first pentaprism SLRs. Treated gently, it can still produce good photographs but the model (and others in the series) is surprisingly underpriced*

East German Praktina IIA *This is a 1950s parallel development to the Contax series. It has an optical as well as a waist-level finder, a clockwork powered motor and a West German retrofocus lens*



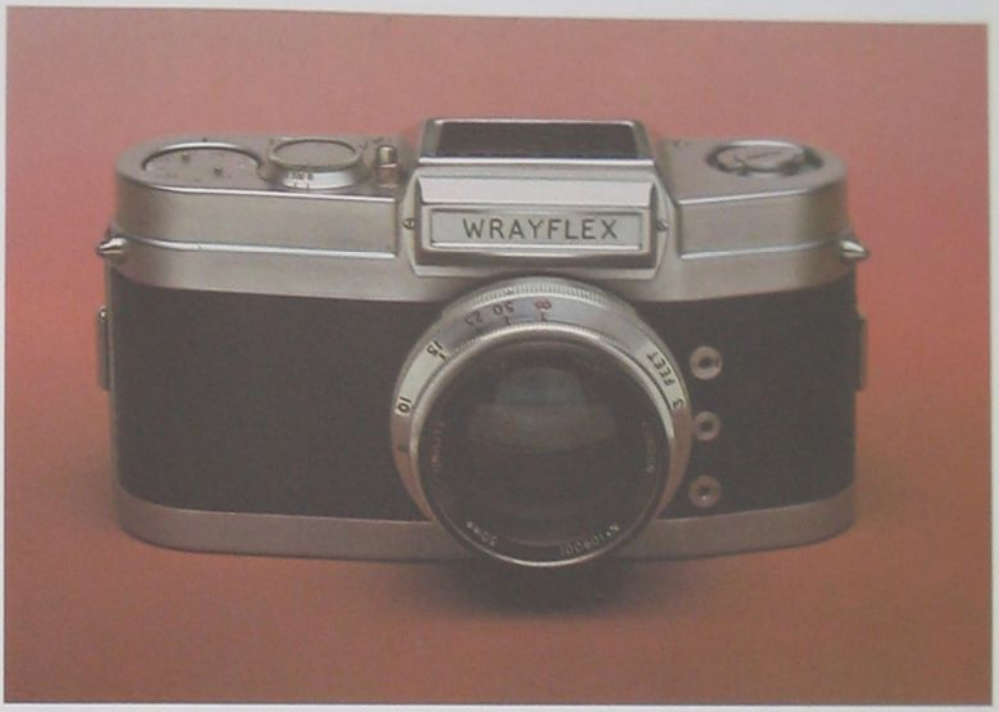
British 1950 Wrayflex *Despite the pleasant streamlined appearance of the camera, the viewfinder gave an inverted image when used for vertical shots, and its image was among the dimmest ever*

The 1936 Kine Exakta *(below) is an important forerunner of the modern SLR. It was introduced as a complete system camera, with optical viewfinder for the standard lens, but it had no pentaprism*

Collectable 35 mm SLRs fall, therefore, into three fairly distinct categories. The first is the 'primitives', the pre-pentaprism types, which are not really very practical. Next come the intermediate models, cameras which are reasonably usable but may lack features regarded as essential by some users. Third are the classics, the old meterless SLRs which many regarded as superior to anything later.

The primitives

The primitive SLRs are usually still very cheap, except for the extremely rare Sport and Gamma Duflex cameras—the owner of a Duflex can virtually name his own price. Old Exaktas are reasonably valuable, though the most expensive of them is still cheaper than a modest new SLR, and Praktiflexes are cheap—less than half the price of an Exakta of comparable vintage.



Colin Glanfield/Vintage Cameras Ltd.

Primitives of the 1950s, such as the Asahiflex, are modestly priced. The Asahiflex is more sought after than most, as the ancestor of the modern Pentaxes (the Pentax name was introduced in 1957). The only drawbacks to the primitives, apart from the difficulties of using them, are that few accessories are available, possibly because few were made, with the exception of the Exakta system. And for any reflex, repairs may be difficult.

Intermediate models

Among the intermediate models, the most popular camera is the Exakta, which had such unusual features as right-to-left film loading together with the option of cassette-to-cassette loading, a left-handed 270° throw winding lever—120° is considered long on modern cameras. The lever cannot be 'inched' and will not return until it has completed its full travel and any attempt to make it do so will break it. The Exakta also had two shutter speed dials offering 1/1000 second to 12 full seconds. You can find interchangeable viewfinders and screens and a magnificent range of lenses from 20 mm upwards.

Exaktas are difficult to operate and you will almost certainly need an instruction book. But these are still available for most models from East Germany, and once you become familiar with the controls Exaktas give enormous versatility at around a quarter to a tenth

The Retina Reflex *(c.1956) is a leaf-shuttered SLR fitted with either Schneider or Rodenstock front component interchangeable lenses*

of the price of a comparable modern camera such as a Pentax LX or Nikon F3. Lenses from the 1960s and 1970s offer fully automatic diaphragms, and the only serious disadvantage is the lack of an instant return mirror.

The landmark Contax S, and its descendants the Contax D, Contax E, Contax F, Pentacon FM and Pentacon F, change hands for next to nothing—a sad fate for a camera which was advertised at $475 in the United States in 1948. Once you are used to the non-instant return mirror, knob wind, and the lack of auto diaphragm, these cameras are actually capable of quite high quality results.

At the other end of the scale, the massive, complex, and beautifully made Contarexes are still very expensive—comparable with a reasonable modern SLR, with additional lenses more expensive—and give image quality second to none. The original 'Cyclops' Contarex, so called because of the large meter cell on the front of the pentaprism, has its peculiarities: notably the diaphragm control, which is mounted on the body and has a non-instant return mirror. The Special (1960) has no meter but does have interchangeable finders, though unfortunately the pentaprism does not show anything like the full screen area.

An offshoot in the evolution of the SLR was the use of Compur-type leaf shutters in the lens instead of the focal plane type. No-one thought it was worth putting a shutter in each lens, like the Hasselblad, for a 35 mm, so the choice of lenses for leaf-shuttered SLRs is very limited—focal lengths were normally in the 35 mm to 100 mm range, though a few longer ones were also made.

The chunky Zeiss Contaflexes are the best examples of leaf-shuttered SLRs, and are frequently found at very low prices. If you only want to use the standard lens, these are still excellent buys, though impossibly expensive to repair—it is often cheaper to buy another one! They use the slow but sharp *f*/2.8 Tessar lenses and have a clear viewing screen which shows a brilliant image but only allows focusing in the very middle.

Kodak's Retina Reflex is another excellent leaf-shuttered SLR, and Paxette and several Japanese manufacturers also made leaf-shuttered SLRs. They are all difficult to repair so it is rarely worth buying one in poor condition. Voigtlander also made superb leaf-shutter reflexes, and have the distinction of offering the first still camera zoom lens, the Zoomar 36–82 mm of 1959.

The Pentax SV *sported a top speed of 1/1000 sec and had delayed action. The clip-on CdS exposure meter and black finish were optional extras*

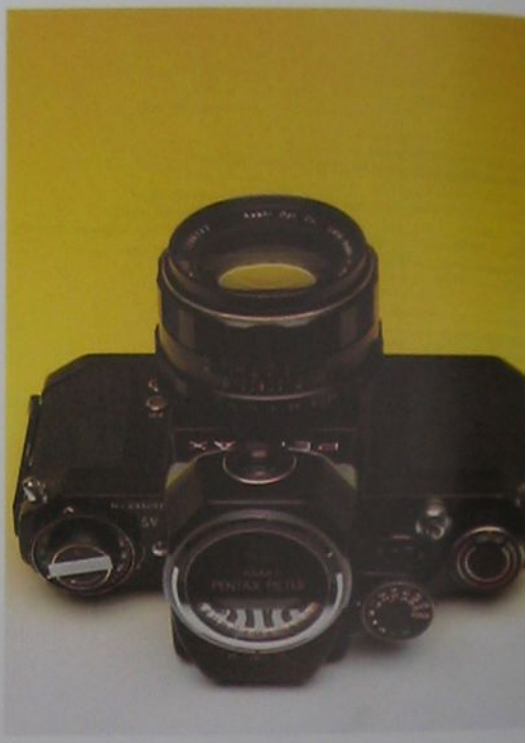
The Nikon F *(1959) had very few external changes during its long production period. Shown here are the 58 mm f/1.4 and 105 mm f/4 Nikkor lenses*

Other cameras from this era include the Exa series (the cheap version of the Exakta), the leaf-shuttered Mamiya Prismat, the Minolta SR-2, the Miranda T and Automatic—'automatic' refers to the diaphragm, not the exposure—the Praktica, the Pentaflex (1955), various Russian cameras, and the Edixa reflex. Unfortunately, although these cameras can be picked up very cheaply, they rarely justify the effort involved.

The classics

The later SLRs, regarded by many as classics, lack only a TTL meter. The best is perhaps the Nikon F, which was produced from 1959 to 1973 with very little change, though a variety of metering heads (never as reliable as the camera itself) was made over the years. With virtually every part interchangeable, these cameras are still very usable and prices are rarely excessive.

The other popular SLR from this era



Olympus Pen F *This aroused much interest when it was introduced in 1962. This model is an early manual which can be fitted with interchangeable lenses and a clip-on exposure meter.*

The Zeiss Contaflex *(below), when fitted with a 50 mm f/1.5 Sonnar, cost about 30 times the average UK wage in 1935.*

The 1950s US Bolsey C *costs much less*

is the Pentax—the 1963 SV is seen by many as the greatest Pentax ever. The S1a was a slightly simplified version of the SV, but had a slightly less convenient focusing screen and the *f*/2 lens instead of the considerably better *f*/1.8. The early Spotmatics (1964) are the only cameras with through-the-lens metering that many purists will use. The meter is virtually the only difference between the Spotmatic and the SV, and so the Spotmatic has all the virtues of the SV in terms of handling, quality and performance.

Although, at first, Canon reflexes were not as popular as their rangefinder models, they were always competently designed and the later metered models, notably the original F1, were very good indeed. Konicas were similarly good but unexciting, but it was a Konica SLR which first had a focal plane shutter to give automatic exposure control (1967). When Konica brought out the Autoreflex T a year later in 1968, it was the first automatic SLR to give TTL metering. So these cameras have a certain amount of historical interest even if they are not of the very highest quality.

Of the other SLRs of this era, the original Leicaflex (1965) stands out. With its external meter cell, it was big, heavy and beautifully engineered and gave superb results. Mamiya, Minolta, Miranda, Topcon and other Japanese manufacturers all made good, solid SLRs in the 60s and early 70s but few were really exciting.

Of course, there were always the rather unusual designs: the Wrayflex (1950) with its mirror reflex system, wrong-way-round eye-level viewing, and 24 × 32 mm format; the Metz Mecaflex, with a 24 × 24 mm format (1953); the Nikkorex (1960–1965), which used a right-way round mirror viewing system but made it seem as though you were peering down a railway tunnel at the screen, and had fixed lenses; and the astonishing Focaflex (1959) in which the light entering through the lens was reflected down to a screen on the floor of the camera and thence up through the semi-silvered mirror again to the pentaprism. More practical than these are the much sought-after half frame Pen F reflexes. If you want to buy one of these look for the FV (meterless) or the FT (TTL) of 1966/67 which are much more reliable and useful than the original Gothic F, which was afflicted with shutter troubles and a double-stroke winder.

Colin Glanfield/Vintage Cameras Ltd.

TLRs

It is often assumed that all 35 mm reflex cameras are SLRs. In fact, a few 35 mm TLRs have been made and they are all fascinating cameras.

The earliest 35 mm TLR was the gigantic and unbelievably expensive Contaflex TLR of 1936, only a little cheaper new than a small car. It was extremely heavy for a 35 mm—weighing half as much again as a Rolleiflex giving 5 × 5 cm negatives. The standard taking lens was a 50 mm. (*f*/1.5, *f*/2 or *f*/2.8), though the viewing lens was an 80 mm to give a decent sized viewing screen. Taking lenses were interchangeable, with the field of view indicated by a mask engraved on the viewing screen, and the hood was a giant brightline van Albada finder (see page 1802). Understandably, these cameras are very rare and command correspondingly high prices.

The others were slightly less spectacular. In 1955, America was startled by the Bolsey Model C, which had a viewfinder and a coupled rangefinder. This is another very rare camera. The Swiss Tessina, introduced in 1959 and still available new in some places, uses special cassettes and it measures only 25 × 50 × 70 mm and weighs just 170 gm. The negative format for the Tessina is 14 × 21 mm and the camera incorporates a spring driven autowinder, giving ten exposures, as well as a full range of shutter speeds (1/500–½ sec), and provision for a wrist strap and a pentaprism. Finally, the Flexilette (made about 1960 with a waist-level finder) and Optima-Reflex (interchangeable pentaprism) from Agfa were short-lived, but may still be found quite cheaply, unlike other TLRs.

There is no doubt that the would-be collector of 35 mm reflexes is extremely well placed. An extensive collection would cost very little to assemble, at least in comparison with a rangefinder collection, and values are bound to go up as mechanical cameras become rarer and rarer: and if you pick the right cameras, they can even take pictures!

Jane Burton

Internationally respected as a wildlife photographer, Jane Burton actually finds many subjects in her garden. But she photographs them in her studio amid natural, authentically recreated settings

People tend to think wildlife photographers spend all their time out in the wild, trekking through the undergrowth stalking an elusive creature or sitting patiently in a hide for days on end. But Jane Burton has made a name for herself as a wildlife photographer by patiently reconstructing the wild in the confines of her studio—and the superb results show that this approach can be equally successful.

Of course, her background could not have been more suitable—zoology seems to run in the family. Her father is the eminent zoologist, Maurice Burton, and both her brothers are also zoologists. Naturally, the Burton home was always inclined to be something of a menagerie—a tradition Jane has continued in her own home. Over the years she has looked after an incredible variety of animals. Parrots, foxes, jackdaws, mongooses, goats, Indian mynahs, dormice and polecats are among the many creatures which were part of the family at one time or another. And, completing the circle, she married into another zoological family and, with her husband Kim Taylor, a rat ecologist, has continued to live surrounded by animals ever since.

Kim Taylor/Bruce Coleman Ltd.

Jane Burton *In the woods behind her house with her collie Tess and Fred, and an albino hedgehog she had borrowed from friends to photograph*

Fiddler crab *These crabs can see so well that Jane had to wait perfectly still for up to 15 minutes before they emerged from their burrows*

It was her father who first encouraged her to start taking pictures of the creatures around the home—partly because he constantly needed illustrations for a weekly column in the *Illustrated London News* and at that time there were few natural history photographers around.

She had no photographic training. 'I just went out and bought a camera and started taking pictures.' However, she had attended an art school in London and was already working as a book illustrator so she had at least a good eye for a picture.

Gradually, she began to devote more and more of her time to photography until she eventually turned professional—supporting herself entirely from photography. At first she sold photographs mainly through a contact of her father's, but then other people started asking her for pictures. Very early on, she met the London agent Bruce Coleman, and was one of the first people to be represented by his agency—now one of the world's biggest agencies for wildlife pictures. She is still with the agency over 20 years later.

Later on, her husband Kim's work took him to East and West Africa, Malaysia and the Caribbean. She made good use of the photographic opportunities offered by the tropical wildlife. Unlike many photographers, though, she concentrated not on the large, more spectacular animals but on the abundant, tiny, fascinating creatures that her husband was working on—Kim's work concerned pests such as rats and mice. 'I always photographed the things Kim was involved with so I have lots of pictures of rats and mice, but I also photographed harmless species—gerbils, desert rats, spiny mice, forest-dwelling species, that sort of thing'.

Jane is inclined to describe herself as a 'small mammal' photographer, though in fact she has photographed just about every group of animals. 'Small mammals have always been a special interest because we kept foxes and other British mammals like stoats and squirrels at home.'

She tends to concentrate on one subject for a while, then move on to something else. 'I might "do" small mammals, until I have photographed all those I've got available. Then I'll move on to fishes for 18 months and I'll think of myself as a fish photographer.'

Jane Burton/Bruce Coleman Ltd.

Crabs, too, will not provide any interesting movement. She has waded through leech-infested ponds to photograph the nocturnal courtship of frogs, and crawled through smelly estuarine mud, ignoring sunburn and midges, to shoot the activities of fiddler crabs.

Most of the time, however, she works in her studio—an old classroom in a Victorian school that is now a business premises shared with her husband. They live in the former headmaster's house next door. Although it has many advantages, working in the studio and arranging artificial backgrounds is far from easy.

'I may spend two days building a set. It has to be ecologically correct—that is, all the plants and so on must be those found in the creature's natural habitat—and the animal has to be happy but visible. If it is a local animal I may go out and gather appropriate bits of heath or woodland. If it is a foreign animal I dip into my collection of stones and plant material from around the world. I can often buy exotic foliage from florists and a lot of people grow bamboo in their gardens.

Jane is careful to take back all the vegetation she removes from the wild. 'I have a thing about that. There is enough devastation around here as it is, with people digging up flowers for their gardens. So I take everything back, water it in and tamp it down to make sure it grows.'

Building a good set requires the skills of a gardener, a flower arranger and an interior decorator. A knowledge of

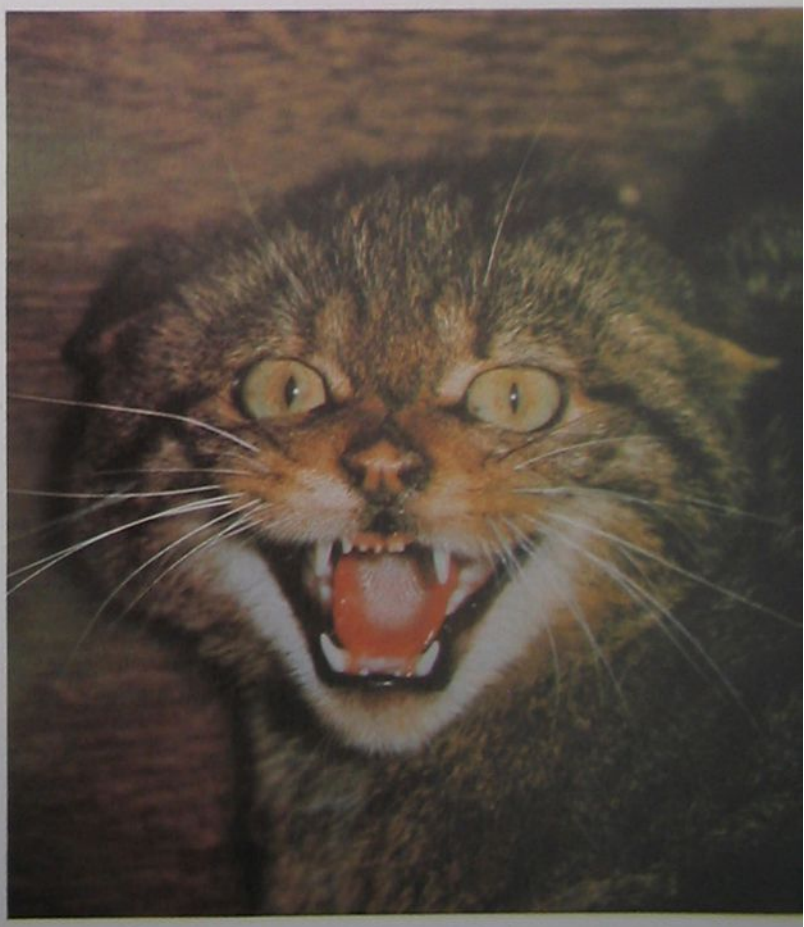
To some extent it is a question of taking advantage of opportunities as they present themselves. For instance, when Jane was living at Nakuru in Kenya, the famous birdlovers' paradise, she photographed birds, even though she does not regard herself as a bird photographer. 'I also photograph the sort of birds that are brought in by neighbours, and become pets—birds like jackdaws, magpies and owls. We are brought quite a few road casualtes—such as owls with broken wings—which can become rather tame. They are not distressed when I put them on a set, so I can take nice close-ups—a full-frame of an owl would be rather difficult with a wild bird.'

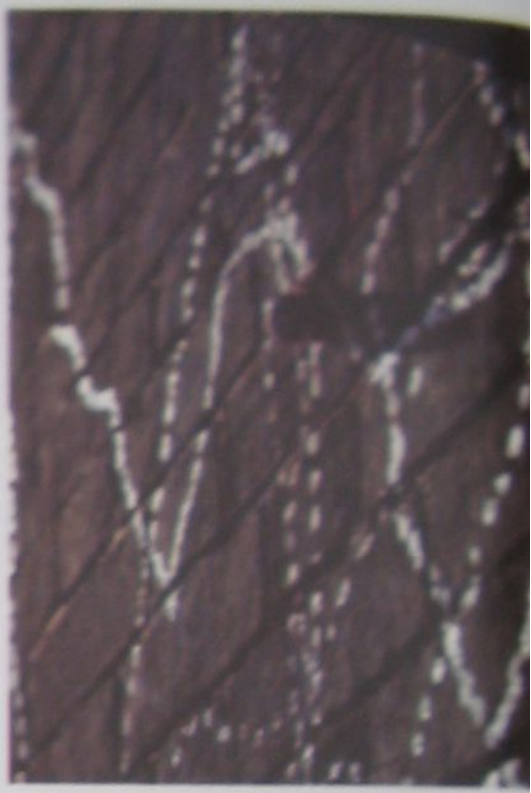
Jane Burton differs from many other wildlife photographers in that her pictures are mostly taken under controlled studio conditions in a contrived setting, a technique that purists who insist on their subjects being 'wild and free', would object to. She maintains that very often studio photography is the only way to get a good picture because some creatures—such as fish and insects—cannot be photographed satisfactorily in the wild.

Nevertheless, she is prepared to vary her approach to suit the subject. Some shots are totally impractical in the studio. Frogs, for example, either sit on a set without moving, or jump off altogether.

Common frog *An aquarium shot in the studio. Jane Burton has several ponds in her garden in which frogs appear each year. She simply collects them and takes them indoors for photographing in the special environments she builds for different requirements*

Scottish wildcat *Photographed at the Highland Wildlife Park, Inverness, Scotland. When the cat saw the camera it immediately reacted violently. Jane used a flash on the camera and actually went inside the enclosures where the animals were kept*





Stag beetles *These male beetles are jousting, each trying to grip the other with his jaws. The beetles were collected in the woods near the studio. Insects tire quickly during photo sessions and have to be fed—on jam*

Snails' trails *The pattern of slime trails left on a wall. Jane Burton's children, when quite young, were very fond of snails. They would collect them during the day and the snails would escape overnight, leaving trails*

botany, geology and ecology help her to avoid using plants and rocks in combinations that would never be found in the wild. Jane Burton delights in matching stones to fish in aquarium photography—not only geographically but by colour too. Green swordtails dart over green pebbles from Trinidad, among green South American water plants, while in another tank Malawi golden cichlids glide over chunks of golden quartz from one of the African great lakes. Some of the images she produces are so striking that other photographers copy her ideas. Jane does not mind this, for she views such emulation as the sincerest form of flattery.

'But you have to get to know your animals—the idea alone is not enough. The first time I try something I often don't get anything. I have a small colony of chinchillas and recently I built them a little bit of the South American Andes, complete with rocks and stunted grass. They were so excited at first that they all jumped about, sending bits of stone flying everywhere. It was hopeless! I had to rearrange the set so as not to have quite so much scree. It took three or four sessions before I got the sort of photographs I wanted.

'With some animals you have to put them on the set for a couple of hours, to give them time to calm down before even attempting any photography. With others you have to start shooting right away, when it's all strange to them and they are investigating their surroundings and really alert—after ten minutes they may decide they don't like it, or they've got used to it and hidden in a corner.

Some sessions can turn into marathons, others may be over in a few minutes, depending on the species. Some sessions can take all night. Photographing the emergence of a dragonfly is a good example. The nymph climbs out of the water up a reed stem in the evening, emerges from the nymphal skin about midnight, expands its wings and dries out in the early hours to be ready for flight to avoid day-flying birds after sunrise.'

She relies on three vintage Hasselblad bodies—the oldest is still dependable after 20 years' hard use. She has four

Jane Burton/Bruce Coleman Ltd.

lenses: 150 mm (her favourite, for general purpose work): 250 mm and 500 mm (for field work, usually hand-held at 1/500 second): and 80 mm (for wide angles, and with extension tubes or bellows for close-ups). She also has a Polaroid back for checking exposure and composition but shoots the final photograph on Ektachrome 64.

Jane seldom takes black and white photographs nowadays. 'There isn't the demand,' she says, adding that publishers do not take very good care of the prints. 'They are quite expensive to produce, but often come back torn and dog-eared—publishers seem to take much better care of transparencies.'

Her studio lighting consists of five Courtenay Colorflash electronic flash units, with focusing light in each flash head. It is the kind of lighting every fashion photographer uses. She has only had the lights for about two years but wonders how she ever managed without them. 'I marvel at some of the results I got in the past—mostly by accident, I think'.

For outdoor work, Jane Burton uses an Olympus OM2, with lenses up to 400 mm and her favourite is the 200 mm. She has an automatic winder but not a motor drive. 'I like to think I can judge the exact moment to take a photograph!' She feels that a day out with her Olympus, perhaps to photograph farm animals, is much easier than studio photography. Unfortunately the results are rarely as successful.

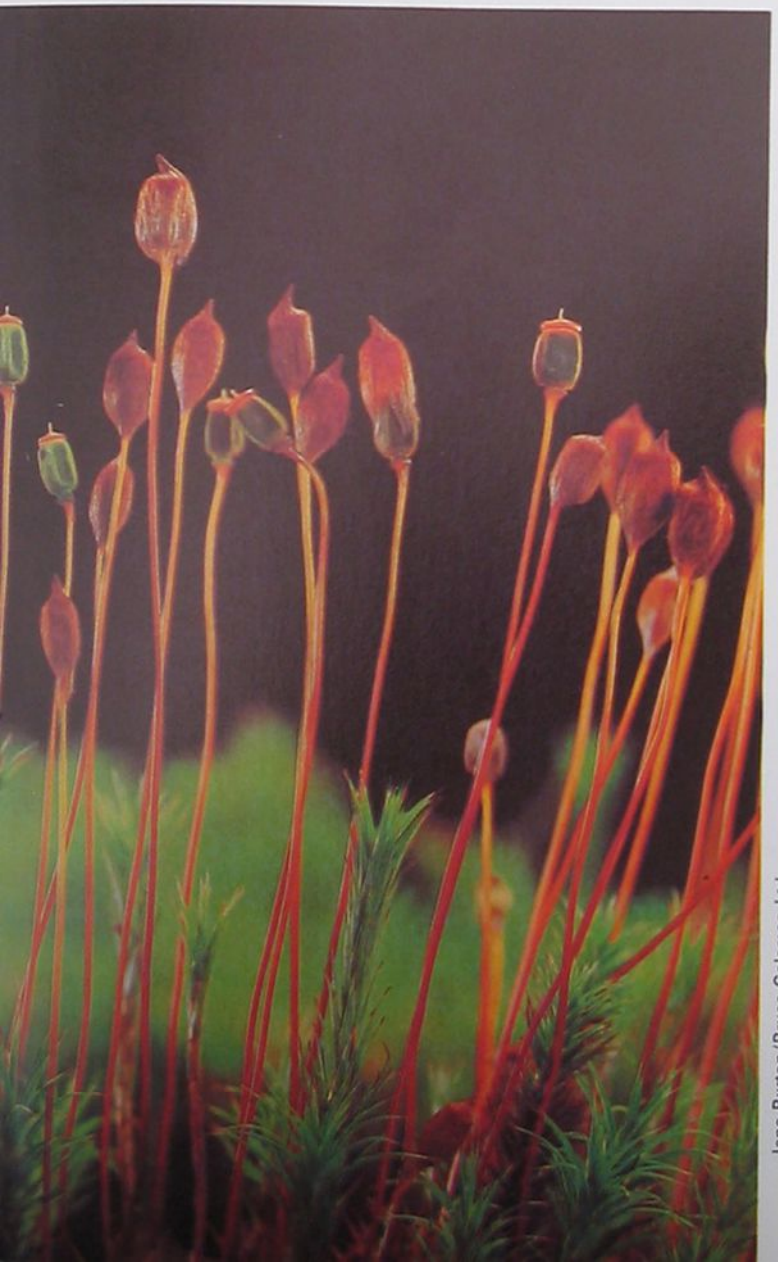
Twenty years of work are reflected in the 50,000 colour transparencies on file with her agent, Bruce Coleman, in London. These include fishes, reptiles and amphibians, birds, mammals and invertebrates. In addition, there is a wide assortment of domestic animal breeds and other subjects like plants, places, geology and weather.

Her extensive collection contains many different photographs of each animal. For example, the card index entry for 'angelfish' lists camouflage, feeding, territorial behaviour, courtship, egg-laying and many more.

Jane jokes that her favourite photographs are those that are most frequently reproduced, but those showing 'behaviour' are among her personal preferences. What she means by 'behaviour' is action. 'Of course, an animal is "behaving" when it is merely sitting still, but I do try to show it doing something definite, like grooming, calling or licking its babies'.

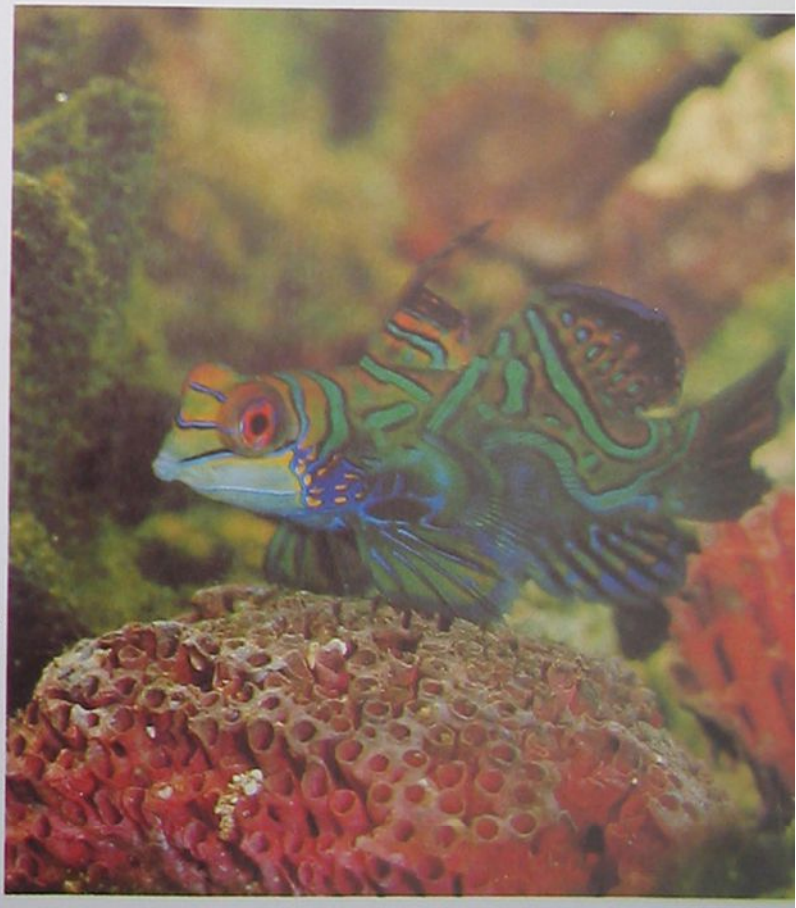
Although her main work is photographing wild animals, she has recently been tackling the many different varieties of domestic rabbits and poultry. 'I've always liked poultry—perhaps I should have been a farmer!' The market for pictures of domestic breeds is not large, maybe because nobody has really photographed them before. 'But I hope that when mine get into circulation, the supply will create the demand.'

With 50,000 photographs already on file, where does Jane Burton go next? 'I would love to keep some Tamworth pigs but that was vetoed by my family.' So after rabbits and poultry she has moved on to cats. 'Not fluffy kittens on coloured velvet, but action-cats on natural backgrounds.' Another possible subject is the pheasant family. 'They are hard to photograph in the wild, and many of them are seriously endangered, which explains, perhaps, why good pheasant photographs are rather scarce. Here, practical considerations neatly coincide with commercial good sense to Jane Burton's advantage.



Hair moss *This female plant, with its 8 cm high spore capsules stenio, is Britain's largest moss. This was shot in the studio with flash backlighting, using a 150 mm lens plus 55 mm tube on a Hasselblad*

Mandarin fish *Another studio shot. At one time Jane Burton had about 20 fish tanks. She particularly enjoys reconstructing the fish's environment as accurately as possible*



Jane Burton/Bruce Coleman Ltd.

Basic dye transfer

Although dye transfer is an advanced technique, it offers the creative and quality conscious photographer an unrivalled, if expensive, means of colour print control

Dye transfer is a painstaking process requiring considerable skill, but for complete control over a colour image, it is hard to beat. Not only can you colour any part of an image in any hue you like, but you can block out any area of detail. Dye transfer can be applied both to 'straight' printing and to a wide range of manipulations. And because it makes use of pure dyes, you can produce brilliant colours with more control than in conventional printing.

The process is so called because the final image is formed by dyes which are pressed in layers on to a coated paper base, giving a complete colour image. Although the process is complex and involves a number of elaborate stages, (see page 1350), with care and practice you can exercise great control over your final image. You can even produce montages without actually sticking pieces of print together—joins are almost invisible even before retouching.

From a transparency original, you make three colour separation negatives, one through each primary filter. These are then enlarged on to sheets of special gelatin coated film called matrix film, which produces an image in relief. When the sheets of matrix film are soaked with dye and printed in register, they produce a colour image. Any combination of dyes can be used, so an image of any colour can be made.

If your subject is static, you need not work from a transparency at all—you can make the separation negatives in camera direct from the subject, using panchromatic film. This considerably shortens and simplifies the process. You can even work from colour negatives, but this is an involved process which needs to be carried out in darkness using special film—panchromatic matrix film. The commonest technique, described here, is that using a colour transparency as your original.

Because of the complex, involved nature of the process, and the careful control required at all stages, dye transfer is used almost exclusively by professionals. It is also costly—a single print can cost you as much to make as two commercially made reversal prints, or the price of several rolls of film. But the outlay can be reduced by sharing the cost between a group of friends.

So, if you are experienced in darkroom work and want the control and image quality which are only possible with this process, dye transfer is worth considering despite the high cost.

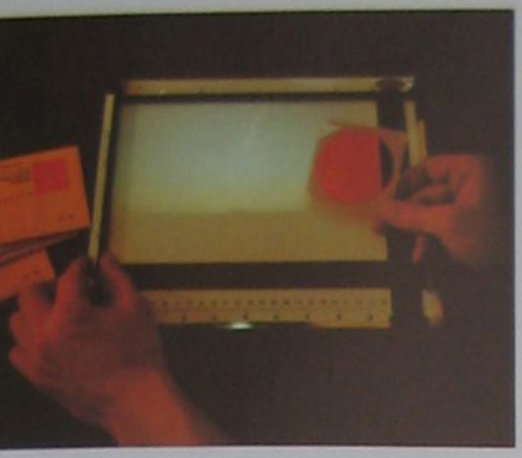
Tim Stephens

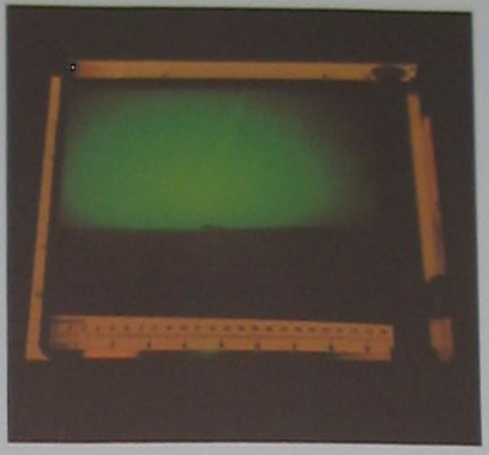
Dye stage *The colour image of a dye transfer print is formed by successive printing of three dye-soaked matrices. Dyes and other equipment for use in dye transfer work are available from Kodak. You will also need squeegees, brushes and a suitable platen for laying down*

Equipment required

As well as the usual darkroom outfit, you need several extra items of equipment. For making separations, you will require primary colour filters—blue (Wratten 47B), green (61) and red (29). The gelatin type is cheaper to replace when scratched. For estimating the densities of your negatives, you need a *grey step tablet*, which is a grey step wedge on film—and if you are going to work direct from your subject, then you should use a paper grey scale. Both of these are available from commercial outlets and they simply show a gradation of grey tones with which you can compare your negative or subject.

Professional printers use a densitometer for making the initial colour separation and working out exposures when printing matrices from these. But you may be able to use your darkroom meter or colour analyzer for determining density and exposure. You can, failing this, judge the densities by eye, but this is not really practicable—a good analyzer or densitometer is essential if you are to make consistently accurate exposures for the matrices.





Separation negatives *Making a good quality set of colour separation negs is vital to the success of a dye transfer print. It is best to use special 'narrow cut' separation filters and proper separation film for this job. You may find it easier to enlarge your original image at this stage*

Because each matrix is printed in turn on the same sheet of paper when you make the final image, each must be registered—so you must have a punch register and register board to ensure absolute accuracy. And because the matrices are used wet, you need both a flat and a roller squeegee to remove excess water and to ensure good contact between matrix and paper when the former is printed.

As well as the special matrix film and the processing solutions (see below), you will need at least seven dishes big enough for the largest prints you are likely to make. And if you plan to do a great deal of dye transfer work, you will eventually find that some way of rocking at least five dishes at once—such as an electric motor operating a cam system—is very convenient.

The dye transfer process can be rather messy, so make sure that you have a large, clear flat surface to work on. Your darkroom should also be as dust-free as possible, because dust on the separation negatives or the matrices can ruin your pictures.

For laying down the matrices and paper, you need a flat stable surface. Professionals use a flat slab of polished granite but a large sheet of plate glass is cheaper and as effective. This should set into a wooden base, as shown, both to prevent movement and to accommodate the register pins. These should be matched to the register punch, and should protrude slightly from the glass surface, so that matrices can be located flat for printing.

Separation negatives

By making monochrome negatives of a colour original through coloured filters, you can produce versions showing completely different tones—these are the separation negatives. In the dye transfer process, you normally make three separation negatives, one through each primary colour filter. Each negative is identified by the colour it prints—the filter's complementary colour. The negative printed through a red filter, for example, is known as the *cyan printer*. This is because they are later used to make relief images on matrix film which, like printing paper, are soaked with dyes of the complementary colours.

When working from a transparency, the separation negatives are made by enlarging the original on to panchromatic film, using the coloured filters on the enlarger. You can either enlarge your original directly on to film the size of your final image—say 20 × 25 cm—or you can make small enlargements, to save on film, and make your full enlargements at the matrix stage.

It is important to make negatives which have similar contrast ranges—otherwise your matrices will not be balanced, and your final print will have colour distortions. If your negatives do not show a fairly uniform density range, you should re-expose the original on three more sheets of film, until you achieve a balanced set. To do this, you must develop the negatives in as similar a way as possible, and put them in a stop bath immediately after development.

Dye transfer requires very high quality separation negatives so you may need contrast reduction masks, with some slides, to retain the full colour brilliance of the original through the later stages of the process (see page 1578). It is simpler, however, to use only slides with a low contrast range.

Separation from the subject

If you are photographing a subject with a definite view to making dye transfer prints from it, you can make your separation negatives directly in camera, eliminating the need for working from a transparency or making masks. You can obviously only do this from a completely

Woodland abstract *Dye transfer is useful when various colour effects need to be tried out and compared—here for a wallpaper pattern. The base image, the vertical trees, is a normal black and white print on fibre based paper. This was overprinted with blue and yellow matrices made from a leaf pattern negative. The result is a mostly green image (left). Another effect was made by using the same matrices in different dyes, adding a matrix for the base image. A three colour dye transfer print gave unusual colours (right)*

Processing matrices

1 *You can process the matrices together or individually. Made-up developer has a working life of only a few minutes*

2 *After the film has been fixed, transfer matrices singly to a dish containing hand-hot water. Unhardened gelatin then begins to dissolve*

3 *Next, transfer each matrix to a final rinse dish to remove all traces of unhardened gelatin. The matrices can then be dried or used for printing*

Tim Stephens

static subject, since you must make three identical, though differently filtered, exposures.

Your camera should be set up on a tripod, in such a way that no movement is possible between exposures—otherwise, your matrices will not register, and coloured fringes will appear, as in certain multiple exposure effects (see page 1397). Any panchromatic film can be used, but Kodak Colour Separation Negative film is especially suitable.

The first exposure is made with a red filter, the second with a green and the third with a blue filter. The resulting negatives are referred to as the cyan, magenta and yellow printers respectively. They should be developed in normal black and white developer, then stopped, fixed and dried in the normal way. It is important that they should receive the same treatment, and that their density ranges should be as similar as possible. To achieve this, the negatives usually require different development times, so it is an advantage if you can use a camera which uses sheet film—the negatives can then be processed separately. If you use a 35 mm or roll film camera, the negatives must be processed together, but you may be able to adjust density and contrast range later, at the matrix stage.

Printing the matrices

When you have produced a satisfactory set of separation negatives, these can be used to make three prints on matrix film either by contact or with the enlarger. These three prints are the colour matrices from which a dye transfer print is eventually made.

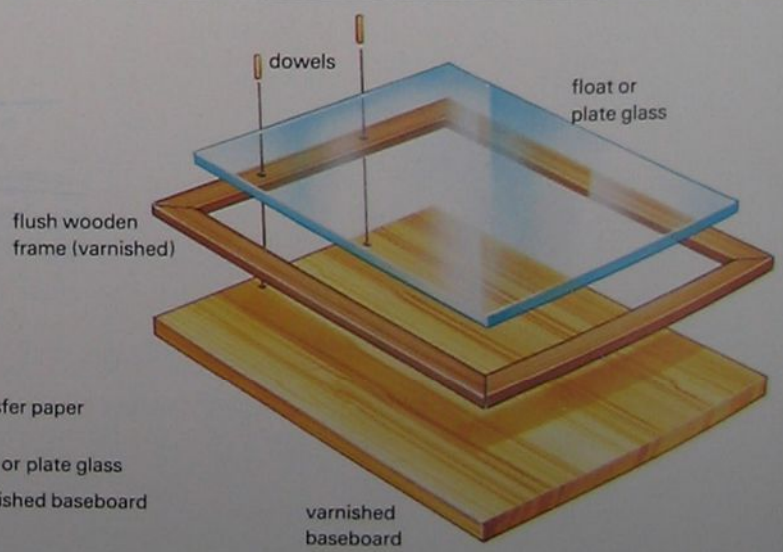
Matrix film differs from other darkroom materials in two main respects. It has about the same speed and sensitivity as normal print paper, so ordinary print paper can be used to test exposure times of separation negatives. But unlike other materials, matrix film is exposed through its base, with the emulsion side downwards. The emulsion differs in that it is unhardened, and yellowish in colour. In fact, the emulsion is made of soluble gelatin, parts of which are washed away in later processing.

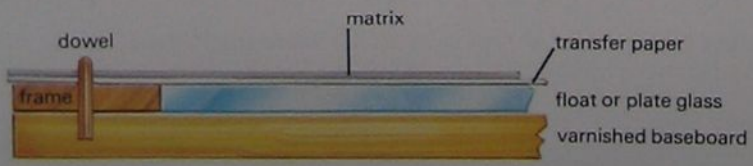
Careless handling during processing can ruin matrix film, so it is advisable to leave a 25 mm border around the edges when sizing up the original separation negatives (or enlargements from these). This also leaves room for register punch holes. Because gelatin suffers from long term exposure to moisture, the storage packet must be resealed immediately after removal of each sheet. Cut up one of these into strips for test purposes.

Ordinary matrix film is only sensitive to blue light and can be handled under normal red darkroom safelighting. Special panchromatic matrix film, used for printing matrices direct from colour

Making a laying-down platen

You can make a suitable laying-down bed or platen using the components shown. A perfectly flat and stable surface is essential to ensure an in-register image. Matrix film is prepunched for use so match your pins to whatever punch system you use. Use the laying-down platen on a slight slope to aid run-off





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negatives, must be handled in complete darkness.

The procedure for making the prints on matrix film is actually quite straightforward. For contact printing from large separation negatives, raise the enlarger head to get as much of a point source as possible. If you are working from enlarged separation negatives, compose and focus the image as for normal printing, allowing for the 25 mm border. Make sure that all extraneous white light is cut out by making full use of negative carrier blinds.

As matrix film is exposed through its support, the original image has to be correctly oriented by printing the separation negatives emulsion side uppermost. To prevent halation, it is important to place a sheet of black paper or card between the matrix film and enlarger easel—the black interleaving paper from the film packet will do.

Using the cyan separation negative, make a series of test exposures just as you would for making normal black and white prints. If you are contact printing, make sure that the separation negative is kept in perfect contact with the matrix film by using a sheet of cleaned glass placed on top.

To be really effective, the test strip should be processed and then actually used to make a dye transfer print. Although this gives useful practical experience of the procedure and techniques, it is tedious for routine work and a short cut is to place a hairpin or a similar small object across a highlight on the separation negative which corresponds to a colourless area on the original. Then make a conventional test strip, ensuring each exposure segment, or step, is covered by the shadow of the hairpin. If you are contact printing, use a number of separate test strips, each exposed for a different time.

After processing (see below) examine the image of the matrix film for the segment which requires the least exposure to show, in relief, the presence of the hairpin. This will take the form of a very faint raised line in the emulsion if you choose the right exposure segment.

Once the cyan matrix exposure has been established, you can take density measurements with a densitometer or colour analyzer from any part of the image you know is neutral grey in the subject. Now replace the cyan separation negative with, in turn, the magenta and yellow negatives and take readings from the corresponding parts of these negatives. Compare readings directly with that obtained for the cyan matrix test to establish times for the magenta and yellow matrix exposures.

If your meter or analyzer cannot be used for spot measurements, repeat the hairpin test for magenta and yellow matrix exposures. Integrated readings—that is from the whole picture area, not just a spot—can be tried on images which have a good, even range of tones but a disproportionate amount of highlight or shadow will lead to failure.

First print *The cyan matrix used for this picture needed half the exposure of the magenta and yellow matrices. The matrices were used normally to print this result, which is slightly flat and a shade too cool when compared with the original—quite encouraging for a first-time run using normal procedures*

Second print *One outstanding feature of dye transfer printing is that you can take corrective steps even as late as the laying-down stage. This second print was boosted in contrast and brightness simply by adding a small amount of extra dye to each dye bath and also a little extra acid to each acid rinse bath*

Tracey Hamilton

Whatever method you use, it may be worth working from an original which contains a grey scale or card, at least for your initial experiements. The progress of this, first through the separation stage then matrix printing, can be followed much more easily than a scrambled, multicoloured image.

Finished matrices look very similar so it is important to identify each matrix immediately after exposure. Matrix film is notched like other sheet films so you can identify the emulsion side more easily in darkness. After you have exposed the magenta matrix, simply snip off the corner nearest to this notch: for the yellow matrix snip off the corner farthest from the notch. The cyan matrix does not then need identifying.

Processing the matrices

The three colour matrices are normally processed together, mainly to ensure that each receives comparable development. You have to use the special two-part tanning developer supplied by the matrix film maker. This oxidizes rapidly once mixed, so it is best to use small quantities prepared before you begin.

You need three dishes for processing, placed close to the water supply. The process temperature is 20°C and you may find it most convenient to adjust the room temperature to this level rather than bother with other temperature control methods.

Before you print the matrices, measure off the appropriate amounts of the two developer solutions, but do not mix these until exposures have been made. When the time comes, mix the two solutions energetically and then begin development. This takes two minutes. Process under normal red safelighting.

A typical normal dilution of matrix film developer is 1:2 and this is suitable for 'average' density range. You may be able to compensate for contrast variations in the separation negatives by adjusting the proportion of the two parts of the matrix developer. Try mixing the solutions 1:1 when processing matrices made from low contrast separation negatives, increasing the proportion of the second solution to three or four parts in the case of high contrast. Add about 30 per cent exposure in the first instance; cut exposure if you exceed the normal 1:2 dilution.

The second dish is filled with water and acts as a rinse bath. The developed matrices are passed through this, for about half a minute.

The third dish is filled with non-hardening (this is important) fixer, and matrices are immersed in this for between two and ten minutes, during which time room lighting may be turned on. Make sure each matrix is quickly and fully immersed in fixer to completely halt development or colour patches may occur in the final print.

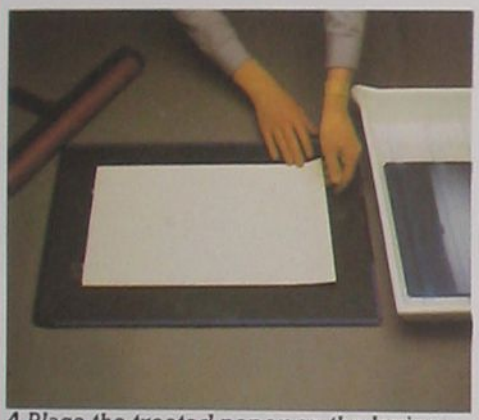
Up to this stage the matrices can be handled and processed as one. When simultaneously processing three sheets of film, it is best to agitate them in the following manner. Place the three sheets, emulsion down on top of each other, in the dish at 10 or 15 second intervals, rocking the dish continuously every few seconds. Then pull out the bottom print and place it on top, repeating the procedure until it is time to take the first sheet out. Remove the other two sheets

Making a dye transfer print

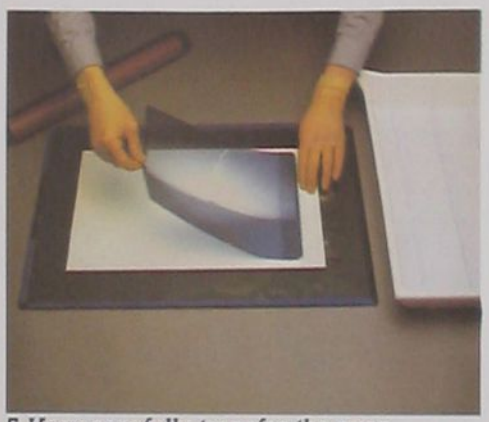
1 *Briefly rinse the matrices in hand-hot water before transferring them to their respective dye baths, where they should remain for at least five minutes*

2 *Remove a sheet of specially mordanted dye transfer paper from its packing and soak it for 15 to 20 minutes in its conditioning bath*

3 *Starting with the cyan matrix, pass it through first and second acetic acid baths to remove all unabsorbed dye. Discard the first rinse*



4 *Place the treated paper on the laying down board. Use a flat squeegee, cloth or swabs to remove excess surface liquid, and to smooth down the paper*

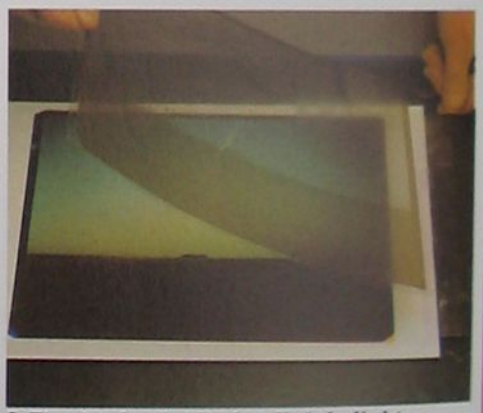


5 *Very carefully transfer the cyan matrix, with the gelatin relief side down Use one hand to keep the matrix clear of the paper itself*

6 *Then, using a suitably large roller squeegee, force the matrix into contact with the paper in a firm, constant, end-to-end movement*

7 *Five minutes later remove the cyan matrix by pulling it up against the roller—an action precisely the reverse of the application procedure*

8 *Hang up the used cyan matrix to dry, or redye it if another print is being made. Continue by laying down the magenta and yellow matrices*



9 *The final print looks slightly lighter so make final judgements when it has been dried. To avoid curling, heat dry the print under pressure*

Tim Stephens

after appropriate intervals. If you prefer, process each matrix individually, using fresh developer for each.

The emulsion becomes very soft by the end of the fixing stage and it is best to continue processing the matrices on an individual basis from this point. The next stage is to wash off the soluble gelatin, and hand-hot water is used for this. Throw away the developer and rinse baths and use these two dishes for rinsing. In the hot water, all the gelatin not affected by the tanning developer is washed away, leaving a relief image in hardened gelatin. Each matrix is rinsed for as long as it takes for the unhardened gelatin and the matrix film backing layer to wash clear. After the hot water wash, transfer each matrix to a quenching bath of cold water to stabilize the relief gelatin image. Hang up each film in the same way to dry. This ensures that any slight directional shrinkage does not affect registration.

Registering the matrices

The matrices have to be registered at some point between processing and printing, but not when they are wet. This job must be done on a suitably sized lightbox, using a good quality punch and register system.

After processing, the matrices look like faint black and white positive slides, and it can be difficult to register images accurately unless there is clearly delineated detail within the picture. For this

reason you may prefer to dye each matrix in its appropriate colour after the quenching bath and before drying. This strengthens the image and helps you register one colour matrix with another rather more easily.

Tape or otherwise fix your register punch on the lightbox, so that you can simultaneously view and punch all the matrices. Place the cyan matrix relief side down on the lightbox, its shortest edge within the jaws of the punch which should be as near flush to the surface of the lightbox as possible. Tape this matrix to the lightbox. Next place the magenta matrix on top, registering the image at several points remote from one another. Look squarely down at the sandwich to check the image superimposition at each point. A magnifier such as a loupe may prove useful.

Carefully tape the magenta matrix in correct register—you will find this easier if the sandwich is weighted, perhaps using the sheet of glass you keep aside for contact printing. Then punch the two.

Remove the magenta matrix without disturbing the cyan matrix which should remain taped to the lightbox, and replace it with the yellow matrix. When this is registered, weighted and taped, punch the register holes. Do not try and register all three at once as this may prove too much for the register punch.

Remove all three matrices from the lightbox and check that the images remain in register when the matrices are superimposed on the transfer board pins. If they are not, repeat the whole exercise using another set of register holes well away from the first set.

Laying down procedure

You begin what is called the *laying down* stage by immersing all three matrices in a bath of hand-hot water, for at least three minutes. As well as expanding the emulsion ready for the dyeing stage which follows, this helps to clean off the matrices.

The cyan, magenta and yellow baths are made up from concentrate dyes which you buy for dye transfer use. A buffer solution is also provided with dye sets to control the acidity of the working dye baths. The degree of acidity controls the image contrast. For normal contrast work, follow the instructions provided with the matrix dye set.

Place each of the matrices in its appropriate dye bath for at least five minutes at normal room temperature, agitating occasionally over this period—this is where you may find an electrically operated dish rocker mechanism particularly useful. But as the matrices come to no harm if left longer in the dye bath, you may prefer to dye each matrix individually rather than attempt to agitate three dishes simultaneously.

A specially mordanted gelatin coated paper is used to receive the three dye images. This has to be conditioned by placing it in alkaline paper conditioner solution for at least 15 or 20 minutes.

Alternative colour

1 *The three matrices can be used for distorted colour printing simply by switching the dye baths, such as magenta for the cyan matrix*

2 *Even when printing distorted colours, apply dyes in the order cyan, magenta and yellow to allow the darker colours to be properly transferred*

3 *With the right original, dye and matrix changes can bring about quite remarkable transformations in a way not possible in conventional printing*

Next take the cyan matrix from its dye bath, draining by one corner until no more dye runs out. Place the matrix in a dish containing a one per cent acetic acid bath for one minute, swishing off surplus dye as you agitate. Then transfer the matrix to a second dish of one per cent acetic acid to remove any trace of dye. Use a swab to wipe 'white' areas.

Position a sheet of conditioned transfer paper on the transfer bed you have made and remove excess solution—this is easily done with a flat-bladed squeegee, which helps also to flatten the paper on the support.

The matrices are normally printed in the order cyan magenta and yellow, so carefully remove the cyan matrix from the second acid bath, draining it for a few seconds to prevent subsequent splashing. Position the matrix, relief side down, on the register pins but do not let the matrix come into contact with the paper just yet.

Pick up a roller squeegee and use this to roll the matrix into contact with the paper, starting at the register pin end. Keep the matrix off the paper until the roller forces contact, but avoid excessive pressure. Insufficient pressure, however, causes dyes in the matrix to 'bleed', creating areas of unsharpness.

You will probably find it easier to work with the transfer bed diagonally to you. One or two practice runs may also prove helpful. If you are plagued by air bubbles, place a small puddle of solution from the second acid rinse bath between the register pins.

Each matrix should remain in position for about five minutes. To reduce paper shrinkage remove each matrix only when the next is ready to be printed.

Throw away the first bath and replace it with the same amount of fresh solution and rinse the magenta matrix for one minute before transferring it to the second acid bath. Replace the first bath solution once again when the time comes to clean off the yellow dye matrix. Remove the cyan matrix and apply the magenta and yellow matrices in turn.

After use, wash each matrix in plain water for a couple of minutes and hang up to dry—ready for redyeing if a is to be made.

You now have your dye transfer print. Wipe off or blot any surplus liquid and heat dry the print under pressure. If you prefer, the print can be glazed but avoid excessive heat. Avoid splashing the dried print as it causes blurring.

Making improvements

If you feel that the colour could be improved in any subsequent print, you can use additives in the first acid rinse. If the highlights appear to have a faint cyan cast, add a few millilitres of Calgon (sodium hexametaphosphate). If you wish to reduce one of the colours overall then use a correspondingly small amount of five per cent sodium acetate solution in the first rinse. Do not attempt major shifts in balance or density by this method or the print quality will suffer. If a large alteration is necessary, reprint the matrices, adjusting density or balance by altering exposure when printing from the separation negatives.

One type of commercially available fabric conditioner, called 'Comfort', can be used for local retouching of excessive cyan dye. Even Kodak Photoflo, diluted to 50 per cent strength, can be used to 'lift' the magenta dye. The matrices can also be reprinted to strengthen a particular colour using mixed dyes.

Understanding...

Monobaths

A single bath process requiring a minimum of control over temperature and time seems to be an ideal way of processing b & w film but in practice there are a number of drawbacks

When black and white film is processed, the developing and fixing solutions are normally kept apart to maintain optimum quality and flexibility. But it is possible to have both of these constituents in one solution—a monobath.

For the amateur, the main advantage of monobath processing is its use for simple processing on location (see page 1422). For a monobath, the photographer need carry only one solution around, and the process requires none of the careful control of temperature and time that the normal two bath process does. Indeed films can be processed in the cassette in a plastic beaker.

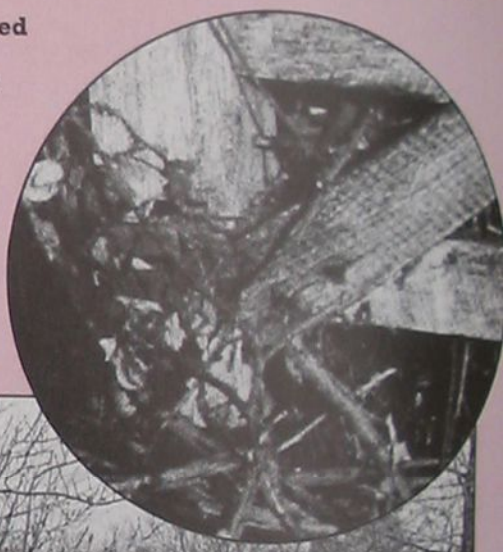
Monobath processing was widely used in the 1960s but it has a number of significant drawbacks and its popularity for general use has declined. Nevertheless it still has various specialized applications. For example, monobaths are sometimes used for processing images on paper from varieties of typesetting machines, and in other graphic processes. Their main advantages for this type of work are the non-critical processing and the single, long life solution which helps to reduce costs.

Monobath chemicals

A monobath contains both a developer and a fixer which operate at the same time. The chemicals used are different from normal two-baths in which the fixers are made acidic to stop the action of the developer. So simply mixing a normal developer with a standard fixer would produce a completely useless monobath because the fixer would render the developer inactive. To avoid this happening the fixers used in monobaths are neutral or even alkaline. They also have a longer *induction period* than normal. This is the time taken for the solution to start working. A long induction period for the fixer gives the developer time to get properly started.

As the fixer starts acting almost immediately, the developer must be very active so that the image is produced before too much silver is removed. A Phenidone and hydroquinone (PQ) formula is most often used for monobaths because this produces a powerful action. But even so, it is usually necessary to have a concentration of Phenidone of up to 100 times greater than for conventional developer. This makes monobaths expensive.

The monobath must also be very alkaline to give the necessary powerful developer action. But this makes it corrosive to many materials (including skin). Also, this alkalinity has a drastic effect on the emulsion of the film. It causes it to swell and soften considerably. While this means a reduced washing time after processing it also means the emulsion is very



Monobath processed *Although quick and easy, monobath processing gives results which are more grainy than normal and lacking in acutance (edge contrast) as can be seen in the enlarged section (right)*

sensitive to reticulation (see page 119) and mechanical damage by handling, and to the accumulation of dirt particles during drying. A separate hardening bath can be used after washing, but this means that two solutions are again needed.

Development is always 'to finality'. The monobath is designed so that when the image is fully developed the fixer has removed the remaining silver, so development cannot proceed any further. This means that over-development is impossible, so you cannot push films using a monobath developer. It also means that the exact processing time is unimportant, so long as a certain minimum time is given. In addition, the processing temperature is not critical as higher or lower temperatures affect both parts of the solution equally.

The development to finality is almost always accompanied by a loss of effective emulsion speed—typically halving the nominal rating. This is because the smallest silver halide crystals, which are usually reduced to silver near the end of the development process, and which increase the image density and effective speed, are the first to be removed by the simultaneous fixation.

The active development also causes unsatisfactory clumping of the silver grains forming the image, giving results which are grainy and not very sharp since acutance type development effects are lost altogether.

Because there is no variation possible in development times, a monobath is usually formulated for one film or group of films. Different developers are made by varying the amount of hypo and this regulates the degree of development. While processing time is fairly short and uncritical—typically five to eight minutes at 15 to 27°C—but the balance between the developer and the fixer content is very important. The balance must be adjusted to suit the characteristics of the film being processed—a fixer–developer balance suitable for one film may be totally wrong for another. So a monobath cannot be a truly universal processing solution suitable for all makes and types of black and white film.

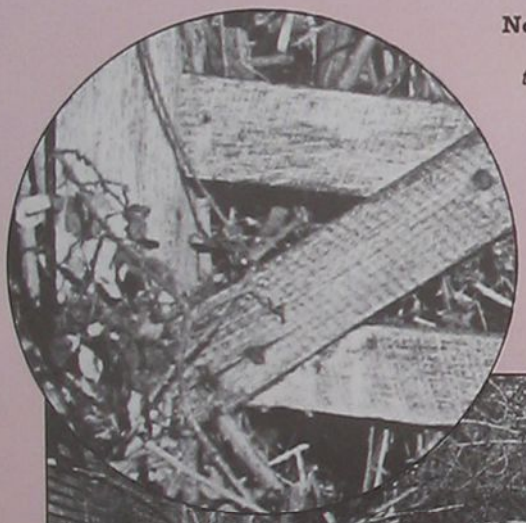
Commercially produced monobaths are either formulated specially to suit a certain film, or as a two solution variety. In the latter, the second solution contains the hypo and is added to the first solution in the right proportion to suit a film or group of films.

Film capacity

The amount of hypo used in the working solution is small and easily exhausted. The very high concentrations of developing agents might seem to give a developer with a large film capacity compared with normal developers—the same solution can be used over and again, theoretically with the same development time for each of a long run of films.

This is largely true in practice, but the low hypo content has two disadvantages. One is that the actual capacity of the solution—the number of films you can process in it—is set by the fixing action. The fixer in the monobath becomes exhausted before the developer so it is possible for a film to emerge developed but not fixed. This means that the film must be immersed immediately in a conventional fixer—again a second solution is needed.

The other problem is that as the solution is used, a large amount of dissolved silver builds up in it. When the solution is left unused for a while this silver precipitates out as a heavy sludge, which can cause problems with subsequent development. Some monobath formulae contain chemicals to minimise this effect. But it always occurs to some extent, and often it is necessary to filter the solution before use.



Normally processed
With conventional two bath processes, development is stopped before the silver grains forming the image clump together—the result is a fine grain, high acutance image (see enlargement)

Bob Cross

Creative approach

Tropical landscapes

Like most successful landscape photography, taking creative shots in the tropics involves making use of the interesting and unusual features peculiar to the region

Anyone visiting the tropics is presented with spectacular scenery that just cries out to be photographed. But when you are back home, sorting through the shots, there are dozens of beautiful pictures—virtually all the same. The stunning scenery tends to bemuse the photographer, whose creative skills seem redundant. Just press the button and you have a classic shot. But if you want shots that are different from those of every other holidaymaker, you must try as hard as ever to be original. This means exploiting the conditions that are peculiar to the tropics.

The tropics do have a special flavour which sets them apart from any other area—a direct result of their particular location straddling the equator. The sun rises rapidly and almost vertically, and at midday it is directly overhead for part of the year. Outside the tropics it is never quite so high. Consequently, one type of natural light that is exclusively tropical occurs in the middle of the day when shadows lie directly underneath objects and everything else is bathed in a harsh glare.

With a large scale subject such as a landscape, there are virtually no shadows visible. While this flat lighting gives little in the way of modelling, there are ways of using it attractively. It does, in any case, help to convey some sense of the great heat that the tropics experience.

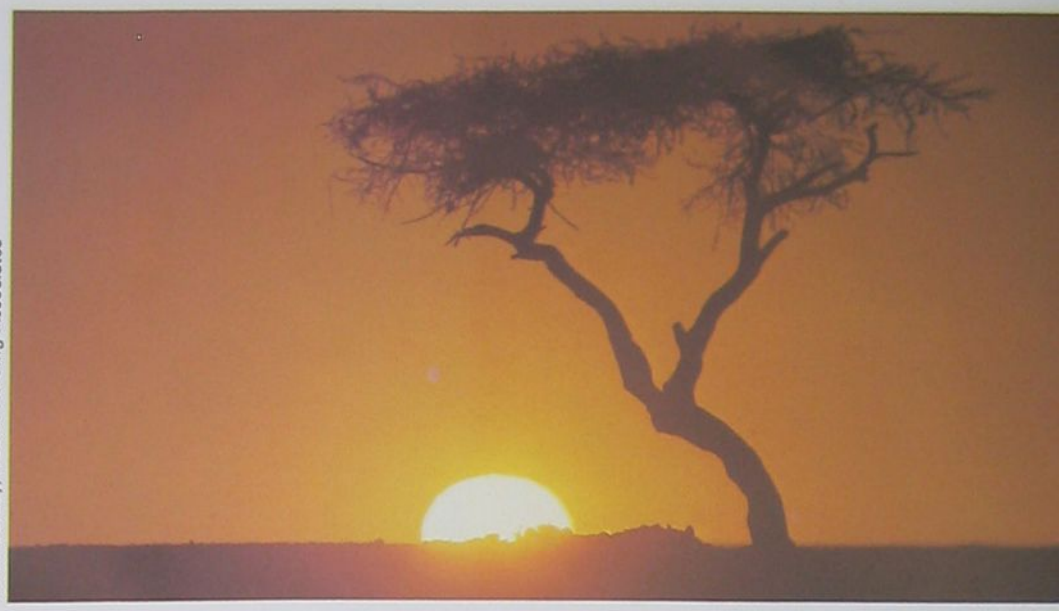
Scenes that have marked differences in tone or colour, and views that have strong, well-defined shapes, generally photograph well under high sunlight such as this. The very flatness of the lighting often helps to emphasize those outlines and colours which are not obscured by prominent shadows. A beach, for example, offers strong graphic images consisting of bold splashes of colour from the rich blues and greens set against white sand.

Similarly, in desert areas where the colour of sand and rock is not obscured by any vegetation, and where rock formations often weather into interesting shapes, the middle of the day is a good time to compose images that have abstract qualities. If you want to exploit these effects fully, try underexposing slightly to saturate the colours. A careful choice of viewpoint helps to clarify and emphasize a particular structure or shape in the landscape, ensuring, perhaps, that a pale background sets off the shape of a darker tree or foreground feature.

Another advantage of high sun is that a polarizing filter has a very pronounced effect, particularly on a blue sky close to the horizon. The strong blue resulting can be used creatively to provide a dramatic background for a tropical landscape.

At any other time of the day you must be prepared to work quickly where the light is an important element because the

Hillside *In this landscape, the patch of sunlight creates a warm area of green to contrast with the stormy sky*



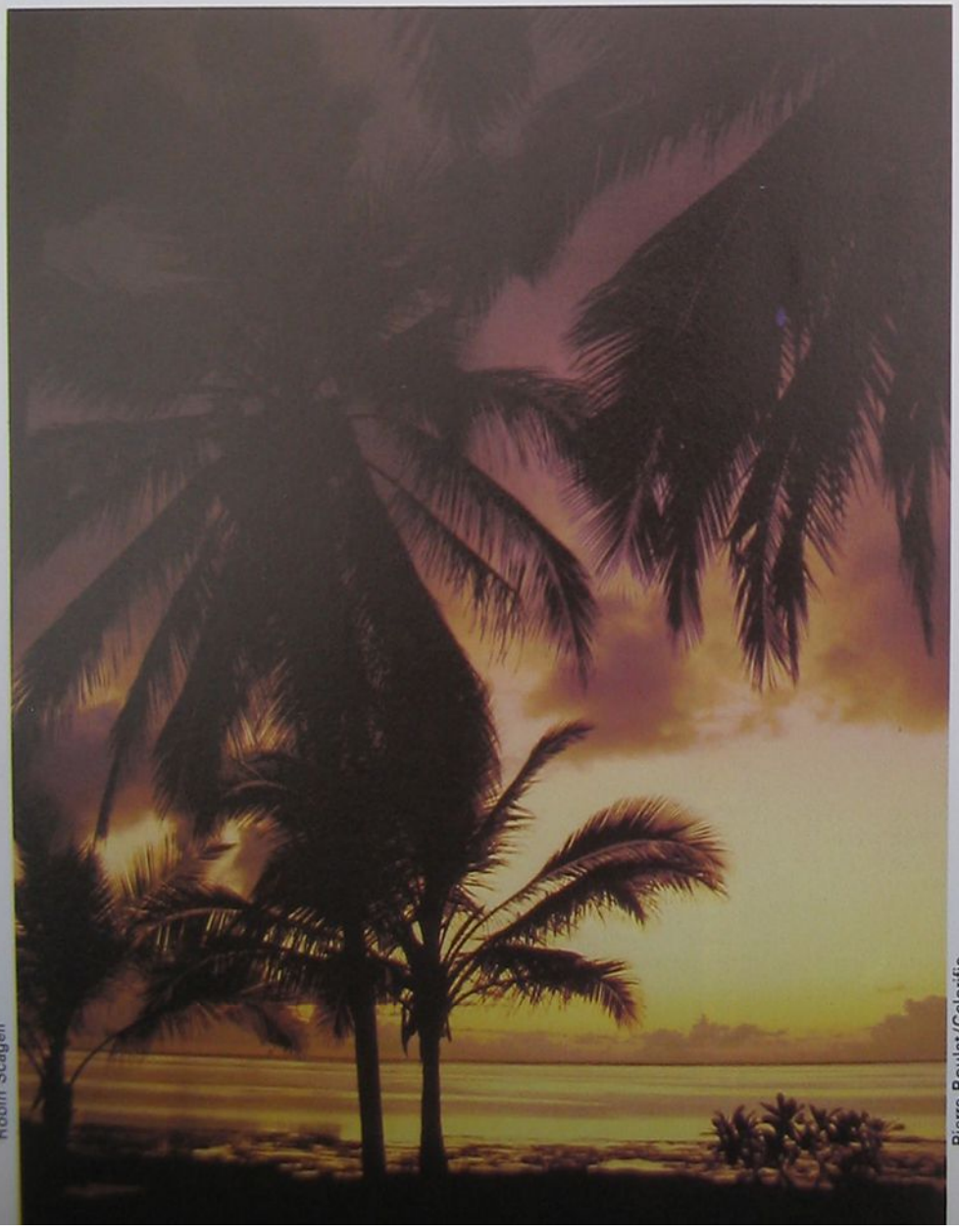
John Gardey/Robert Harding Associates

sun rises and sets in tropical areas much more quickly than it does in temperate zones. The sun rises and sets almost vertically and can be captured on film by using a very long time exposure. Using a slow film, small aperture and several neutral density filters (giving a density of about 4), you will find that you can extend an exposure, even of a low sun, to several minutes. If you use a telephoto lens, you can concentrate on one small section of the sky fairly close to the horizon. You will see that the image of the sun appears to move very quickly in the viewfinder, so you should begin the exposure just as the sun comes into view at the top of the frame. This will result in nothing but a vertical line as the sun sets, so during twilight uncover the lens again for a second or so to expose some landscape details on the same frame.

Tropical twilight often has very unusual colouring, which you can photograph quite easily with time exposures of a few seconds. The only problem is that the palm trees which often form an important part of such a scene will move in the breeze if more than a brief exposure is used. One solution to this problem may be to photograph the dawn sky, when the wind may be less

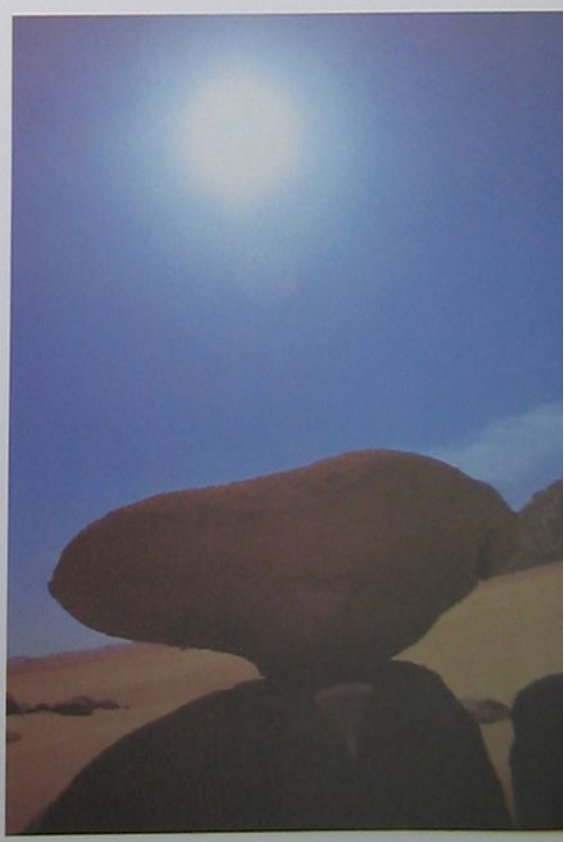
Sunset *A telephoto is often best for catching a setting sun—it magnifies the size of the orb and silhouettes gain more impact.* **Palm trees** *This picture was taken at dawn, when the lack of wind allowed a long exposure time*

Tropical weather brings its own variations, often dramatic, to both the light and the landscape itself. Although bright sunlight seems to typify the tropical day, the weather conditions that strong, particularly near the coast.
are actually unique to the tropics are the storms and rain. Depending on the season and on the actual location in the



Robin Scagell

Rock *Shooting straight into the sun can give a sense of heat as well as enhancing the shape of the main subject*



Pierre Boulat/Colorific

tropics, one of the most memorable sights is that of an afternoon storm building up. Tropical areas receive so much heat during the day that they experience quite regular late afternoon rain which is often accompanied by a storm. The resulting thunderclouds make impressive additions to a landscape photograph, and usually cause violent but brief rainstorms which bring dramatically changing conditions, often clearing completely by sunset.

Since these convectional storms cover several kilometres of altitude, their aftermath is frequently a sky scattered with many different types of cloud, and it is this, more than anything else, that makes tropical sunsets so interesting. These cloud formations can disperse very quickly, so it is a good idea to find a clear view over the countryside well in advance of the predicted storm, and wait for the weather conditions to develop. The comparative predictability of the weather makes this easier in the tropics than in temperate latitudes.

Night storms are typical in some tropical areas, but are not as easy to photograph. They are best photographed with high speed film, as the clouds are usually dense, withholding much of the illumination from the lightning. In these cases mount your camera on a tripod, use a fast lens at maximum aperture, and leave the shutter open until one or more flashes of lightning have occurred in the direction your camera is pointing.

Parts of the South East Asian tropics experience another, very specific, weather condition—the monsoon. In its most extreme form it brings continuous, torrential rain, and while for general photography it can pose great practical difficulties, it can occasionally make very impressive photographs. It is not a season to recommend for a visit, but if you happen to be there at the time, rather than pack your camera away put it in a plastic bag with a hole left open for the lens and try to capture the wetness and force of the most extreme rainfall you will probably ever experience. Outside the tropics, rainfall tends to appear weak and rather mistlike in photographs because it is not heavy enough to register on film, but the tropical monsoon provides a good opportunity to photograph a landscape bathed in drifting sheets of heavy rain.

Simon de Courcy Wheeler

Empty beach *A polarizer helps to intensify the colours and underline the tropical flavour of a scene*

Bob Croxford

Stepped fields *Unusual features are well worth photographing—here the palm tree adds extra interest*

Another seasonal type of bad weather comes from tropical cyclones which build up rapidly and can become very violent indeed. Once you find a sheltered place to take pictures from, try to capture the extraordinary effects of this extreme weather, such as palm trees bent almost double in the strong winds.

Tropical landscapes are as varied as any other, but one of the most well known is the rainforest, which for many people is the classic jungle, but is not easy to photograph well. Because it is so dense, there are few places where

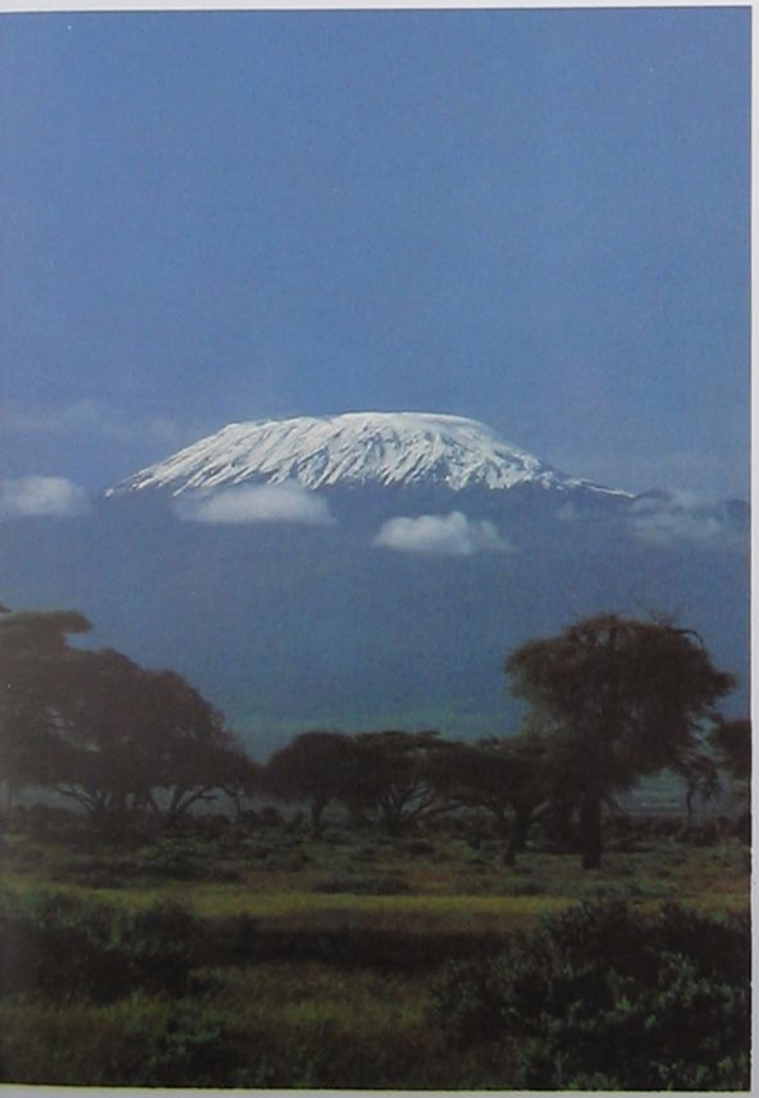
Field workers *A high viewpoint enabled the photographer to include colourful figures working between the bushes*

Michael Freeman

you can see any distance, and most successful photographs of it are taken from beyond the margins of the forest itself—from across a river, or from a cliff top, a high rock or even from an aircraft. Nearer the forest, bright colours, such as those of tropical birds or flowers, can provide a sharp splash of colour as a contrast to the dark green vegetation.

A different type of tropical landscape, and probably the one with which most people are familiar, is that of the coast, whether coral reef, white sandy beach or mangrove swamp. One successful way of photographing a tropical beach is to use a telephoto lens to compress the planes of sea, beach and palm trees fringing the shore so that an almost abstract composition is formed from the distinctly different colours and textures of each area. Alternatively, a wide angle lens can include foreground details, such as exposed coral or shells washed up on the sand, together with a background seascape. Palm trees are frequently a part of tropical beach scenery, and are best photographed in a very graphic way, so that their shape dominates the picture. On the other hand,

Kilimanjaro *Like many volcanoes, it stands alone and its snowy summit contrasts with the foreground bush*



Jon Gardey/Robert Harding Associates

Sail silhouette *Dramatic skies are another feature of the tropics and can make subjects in their own right*

J. Pragescar/Atlas Photo

Thunder cloud *Unusual weather conditions often develop rapidly—do not leave your camera indoors!*

you can make use of them as effective silhouettes, particularly at sunset, as a frame for the distant sea and sky.

Palm trees are also a common feature in the cultivated landscapes of the tropics, either as closely packed lines of large plantations, or in small clumps dotted among rice fields. The highly distinctive appearance of such manmade landscapes makes them natural subjects for photography, particularly when the paddy fields are flooded in the wet season or under irrigation. At these times the waterlogged fields, delineated by narrow earth ridges, can make strong, graphic patterns. You can make the most of these in a creative way by choosing a high viewpoint and using a telephoto lens to catch the reflections of sky and clouds in the water.

In the early morning or late afternoon, if you photograph against the sun, you will obtain an effect of very high contrast, which can easily be made into abstract compositions. In some parts of tropical Asia, paddy rice is grown on spectacular terraces, whose lines follow the contours of the hill slopes. Again, the most effective views are generally those which look down on the descending fields, exploiting the patterns made by their ribbon-like structures.

A quite different type of tropical landscape is provided by the deserts. While deserts are by no means exclusively tropical, those in the tropics represent most people's ideas of what a desert should be. The sandy, dune landscapes can make spectacular pictures when photographed under low, raking sunlight which emphasizes the snaking relief of wind-forming drifts. The lack of vegetation in the driest deserts gives a starkness to the landscape that can be revealed well in abstract compositions. The best pictures are usually taken within an hour or so of sunrise and sunset.

Mountain ranges close to the equator are quite different in appearance from those in higher latitudes. The most marked difference is that the heat of the tropical sun forces the snowline much higher. The vegetation changes noticeably as you climb up higher, with marked bands at various heights—a great variety of landscapes arranged vertically. In some parts of the tropics layer after layer of completely different landscapes can be seen on the slopes of a single mountain. This extraordinary sight makes a natural subject for photography. A long telephoto lens is essential and it is worth experimenting with different viewpoints until you can see a clear definition of each area in your composition.

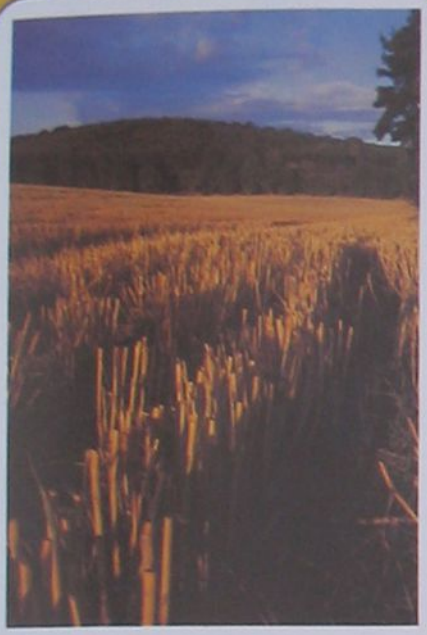
Stephen Dalton/Oxford Scientific Films

Venezuelan cloud forest *By filling the frame with foliage hanging in the mist, a claustrophobic feel has been conveyed*

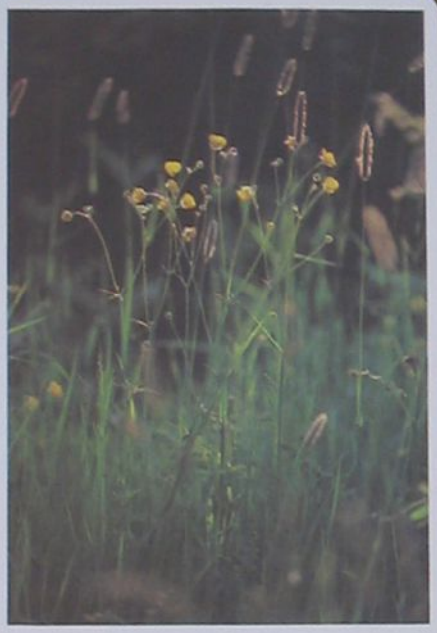
What went wrong?

Out in the field

Five pictures taken in the countryside featuring grass and straw—nice shots, but as Sergio Dorantes points out, they could have been improved



A wide angle lens has been used here for a picture with very large depth of field, strong colour and graphic composition. But there are ways in which it could have been made more pictorial. With more careful framing of the scene, the tree in the top right hand corner and the large dark area in the lower right hand corner would have been eliminated. The result would have been a colourful and graphic picture consisting of the straw, the hills and the sky.



In most cases, back light adds interest to a picture. Here, it has given the blades of grass both a glowing quality and rich colour. Lacking a definite focal point, however, the image is broken up, as the viewer's eye tends to wander all over the frame, trying to focus on each of the flowers at the same time. Their particular arrangement does not in itself create a composition to which the eye is drawn. In such situations, it is often better to simply isolate a single flower or blade.

The pictorial effect of this photograph has been ruined by the photographer's failure to exclude the power lines from the background, which were probably not visible in the viewfinder when used at full aperture. In silhouette pictures such as this, a clean background is essential. Make a habit of looking for an angle of view which produces a suitable background even when the lens is stopped down to the aperture you will use for taking the picture.

A potentially good subject has been wasted here by the photographer's poor choice of the time of day. Light can transform a subject from being mundane into being exciting. Here, the scene needs to be photographed at a time of day when the light can add interest to it, such as early in the morning or late in the afternoon. If you cannot take the picture then, it is better to not take it at all. Besides the uninteresting light, here the subject matter is presented in an ordinary way: the large area of sky is totally devoid of detail and the subject is partially hidden.

For a pattern to work as a successful photograph, a very tight composition is needed which captures the tension caused by the repetitive elements in the picture. This is missing here. The top of the picture, where the grain stems recede into the distance, takes attention away from the stems of grain in the main part of the picture. All that would have been necessary to improve this aspect of the photograph would have been to remove the top part of the picture by a slight change in the camera's angle of view, or by moving slightly closer in.

Slide combinations

The creative part of making pictures need not end with processing. With a slide duper and a few basic techniques you can produce unusual and fascinating images by combining existing shots

Slide copying can be used for much more than simply producing exact duplicates of an original transparency. By combining pictures it is possible, even with fairly simple equipment, to create fantastic or graphic images. You can turn dull or unsuccessful shots into interesting pictures and produce effects which cannot be achieved any other way.

The advantage of working from transparencies is that it is relatively easy to imagine the final effect beforehand. There is no reason why you should only use ordinary colour slides; black and white and colour negatives, lith negatives and positives, coloured gels, tinted pictures and so on can all be combined. The possiblities are endless, and to get the most out of this type of work it is essential to experiment. The techniques in this article simply provide a few basic ideas to get you started.

Richard Haughton

Misty mountains *An ethereal effect has been created here by adding a separate cloud shot to the mountain picture*

Choosing the pictures

One of the first things you have to do is to decide which pictures you are going to combine. There is always some loss of quality when a picture is copied, so the shots you use should be technically good. Badly underexposed, high contrast or unsharp pictures should be avoided.

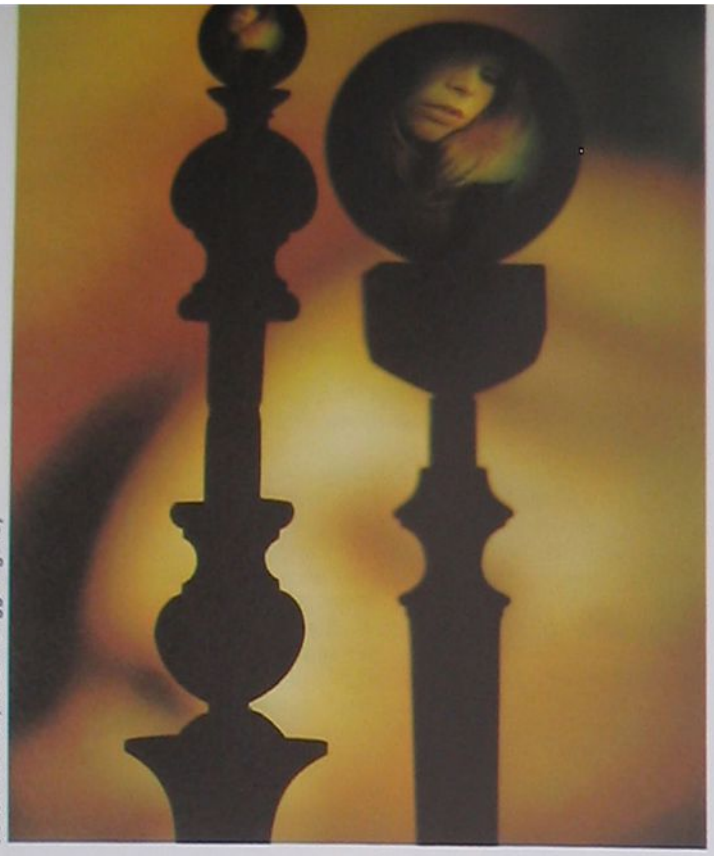
The best pictures are those which are fairly simple. Heavily detailed shots often make confused and messy combinations It is usually better to have the main subject, such as a face, surrounded by a plain tone or simple texture. This allows detail to show through from another slide.

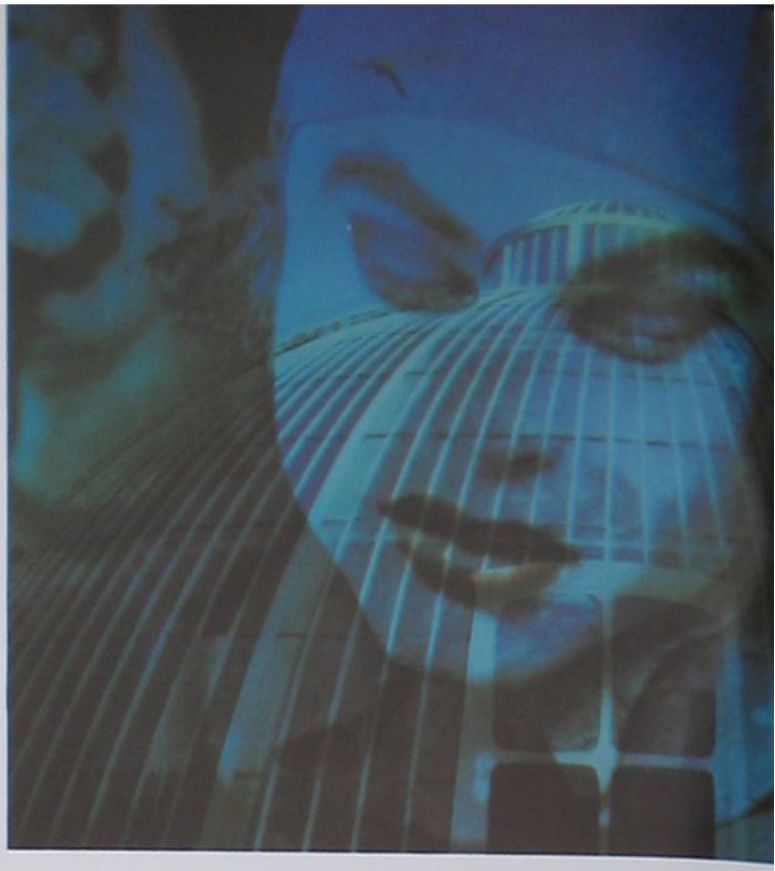
Having chosen a range of shots, it is a good idea to plan the combinations on a lightbox. Number the pictures so that when you find a promising combination you can simply note the numbers down. This saves time when it comes to actually copying the pictures. To avoid damaging the shots through constant handling it is best to put them in transparent sleeves so that they can be viewed while remaining protected.

Straightforward slide copying is described on pages 726 to 729 and the basic procedure for combinations is similar. In all cases, you should shoot test films. Once you have established a standard set-up, the exposures will be fairly constant. However it is still a good idea to bracket in steps of half a stop over a range of two stops—start with slightly more exposure than for a straight copy.

For most of these techniques, you need surprisingly little in the way of equipment. Even simple, fixed focus copiers (see page 1220) can give sophisticated results. But if you want to do this type of work regularly, a few additional items may be useful. A movable slide holder, for instance, helps give you complete control over the composition. A copier which allows you to magnify part of the picture is also an advantage. Without doubt the best type of copier is the bench top type. Many of them have built-in meters and exposure compensation scales which are invaluable when you are combining two or more very different transparencies.

But whatever equipment you use, there are two main approaches—one is to





Julian Nieman/Susan Griggs Agency

physically place the originals together as a *sandwich* and then copy them as if they were one shot, and the other method is to use multiple exposures, shooting each picture in turn on to the same frame of film.

Making sandwiches

Using two transparencies sandwiched together is by far the simplest method, and can be very effective. The best types of pictures to use are those which are high key or slightly pale, because when they are placed together they combine to give a normal density. Normal or underexposed shots often become too dark when added together.

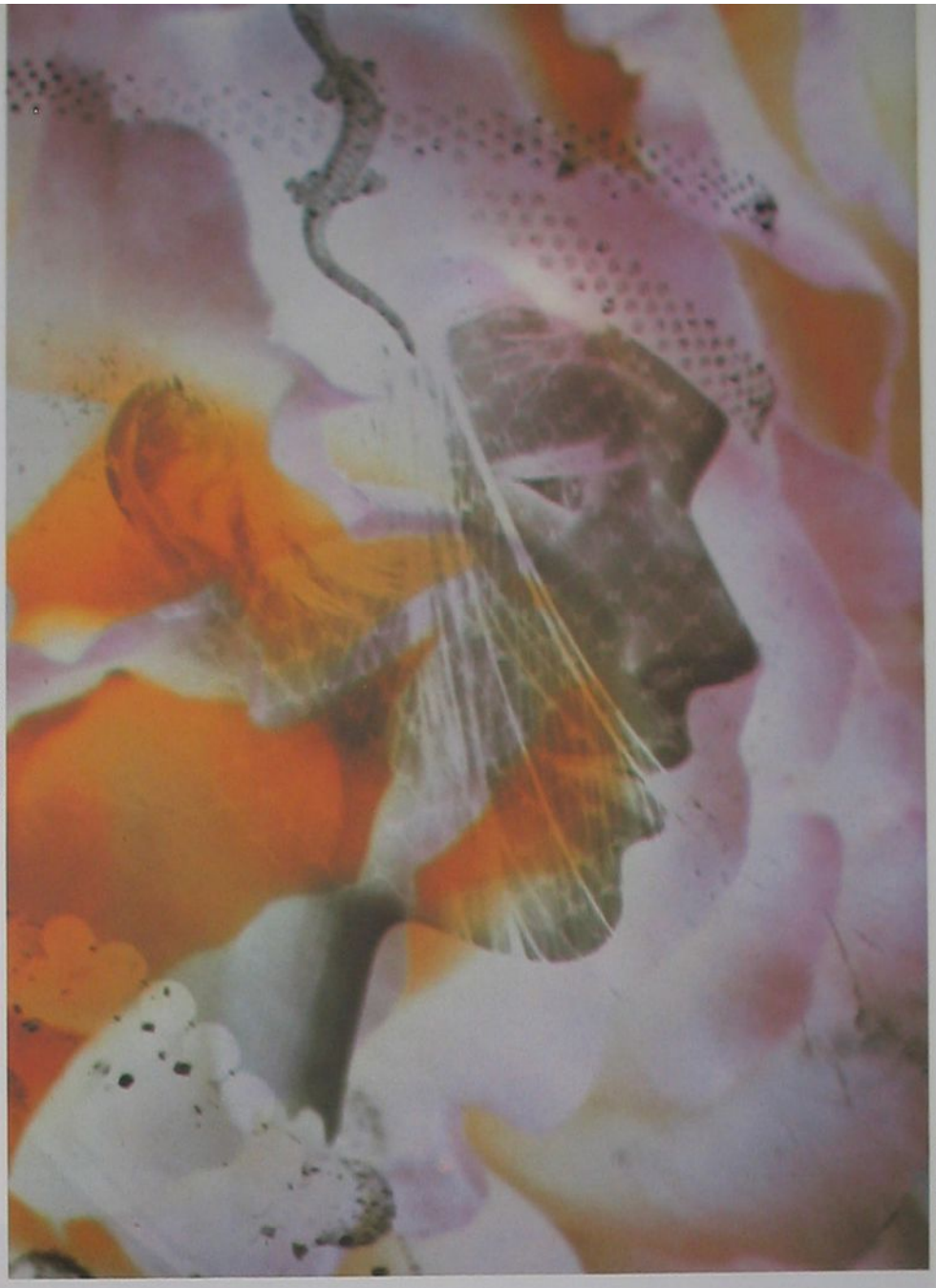
If possible, always sandwich the transparencies emulsion to emulsion. This avoids problems with focusing and depth of field when duplicating. For the same reason the pictures should be bound together in a slide mount. If necessary, glass mounts can be used to keep the transparencies flat and in contact with each other.

Black and white negatives sandwiched with colour transparencies work quite well. And if you want to use black and white positives, these are easily made by copying or contact printing the negatives on to continuous tone film.

Sandwiching colour or black and white

Sergio Dorantes

Richard Haughton



Richard Haughton

Combination variations *These pictures show a variety of effects made possible by combining shots. Subtle pictures can be created with multiple exposure (above left), though the separate elements need careful positioning. Sandwiching shots (above) is a simpler technique, though still very effective. Sandwiches often work best when the original shots are quite simple (below left), or unusual, as in the shot using negative images (right)*

transparencies of different subjects to give a surreal, montage-like effect is interesting. But you should also consider sandwiching almost identical shots. For example, two shots of the same view where just part of the subject has moved slightly between exposures. Strange effects can also be achieved by sandwiching identical shots slightly out of register, especially if one of the transparencies is quite pale—perhaps a slightly overexposed duplicate made from the original picture.

Sandwiches do not necessarily have to consist of two photographs. You can, for instance, sandwich one transparency with coloured gels, paper or other translucent materials. The grain in paper can be used to give a textured effect. Gels can bring alive an otherwise dull shot by introducing a strong or vibrant colour, or they can be used to create mood. For example, a blue gel used with a transparency which has slightly pale highlights gives a moonlight effect, especially if the copy is underexposed by half a stop.

Gels are also useful for colouring selected areas of the picture. If you do this, make sure that the gel is not in contact with the transparency so that the edge of the gel is out of focus and does not show up as a hard line. This technique is useful for adding tone or colour to the sky in a landscape in a similar way to using a graduated filter.

Unusual combinations

If you are interested in producing odd colour combinations try putting together pictures taken on different film stocks, such as infrared. This works particularly well if the two pictures are identical except for the film used. Pairs of shots like this are easy to produce by copying a normal original on to another film. Although this technique does not work with infrared film, it works very well with other materials.

One of the best techniques is to sandwich the original slide with a copy or slide film processed in negative chemicals (see page 1534), giving a little extra exposure to prevent the result becoming overdense. Processing in negative chemicals gives slides in which the colours appear as complementaries, objects which are yellow in the original appear blue, for example. The tones are also reversed as in a negative. When you make the copy for processing in negative chemicals, put the original in the copier the wrong way round so that the two pictures can be sandwiched emulsion to emulsion.

This technique can be used to produce a strangely coloured bas relief effect by sandwiching the original slide and the negative copy slightly out of register. But it is also possible to produce bas reliefs with black and white materials. A negative sandwiched with a positive (produced by contact printing the negative on to film) gives an interesting three-dimensional effect. The negative should be quite thin to allow some tones to show. Coloured gels can be added to the sandwich and the whole copied on to colour slide film. The positive can also be toned the same or different colours—Colorvir is good for this technique (see page 1767).

One problem which often crops up when copying is high contrast, particularly when you are making a copy of a copy. But contrast is relatively easy to

reduce by using masks. Contact printing the original on to Kodak Pan Masking Film 4570 gives a negative which, when sandwiched with the original, reduces the brightness of the highlights (see pages 1578 to 1581).

These low contrast masks can also be coloured using the Colorvir process. Alternatively, the mask can be copied on to colour transparency film using a coloured gel and the copy sandwiched with the original.

Going to the other extreme, high contrast masks, produced by contact printing the original on to line or lith film, can give very dramatic results. By varying the exposure when making the masks you can control which parts of the picture go dark. For example, you can produce jet black clouds floating in a red sunset.

Multiple exposure duplication

In spite of the versatility of sandwiching, there are some effects which can only be achieved by using multiple exposures, or which can be done better in this way. If, for example, you want to add a large moon to a landscape shot, double exposure is by far the best technique. Simply sandwiching the two shots would give a moon where the highlights are degraded by the tone in the sky. Double exposure causes the highlights to burn out because you are adding light rather than subtracting it. So with this method the highlights come out bright and clear.

The other main advantage with multiple exposure is that it allows masks to be used. If you want to use just part of a picture the rest can be masked off with thin black card. For best results the card should not be in contact with the transparency but held slightly above it to give a soft edge. Cutting and using masks is not easy, but with practice quite spectacular combinations are possible.

The principal difficulty with multiple exposure, particularly when you are using masks, is in getting the pictures properly aligned. It is possible to use sketches of the various elements of the picture as seen in the viewfinder as a rough guide, but this can never be completely accurate. A feature which is very useful for this technique is a focusing screen with a grid marked on it. This type of screen is available as an accessory for most cameras which have interchangeable screens. The grid makes it much easier to sketch the view through the finder. A better method is to use a camera with a detachable viewfinder, such as the Pentax LX. With the finder removed, the position of the first transparency can be marked directly on to the focusing screen with a wax pencil. Subsequent transparencies are then aligned with this sketch.

Another problem you may encounter is the lack of a double exposure facility on your camera. All cameras can be made to give multiple exposures (see page 513) but there is often some inaccuracy in registration. If you intend doing a great deal of combination work, it is worth considering buying a camera with a built-in multiple exposure facility. The alternative is to work in a darkened room, with the camera shutter set on 'B', firing the flash manually for each picture. However, this method does not allow you to check the positions of the shots at all and so is not recommended when accurate alignment is needed.

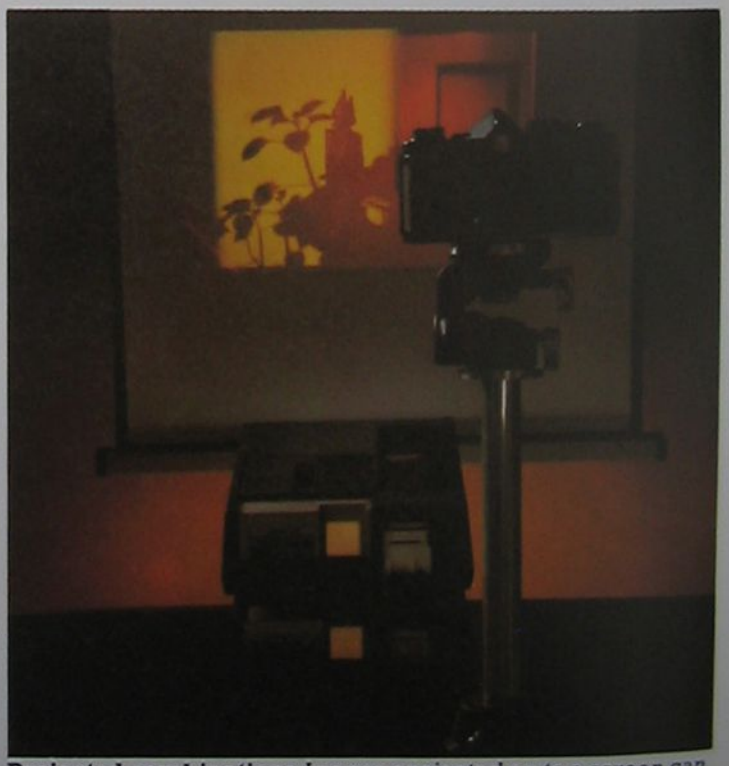
Colour posterization

With the multiple exposure technique it is also possible to make colour posterization directly in the camera. The basic procedure for posterization in the darkroom is described on pages 1180 to 1183, and the same principles apply for posterization by copying. Separations are made on lith film from an original—either black and white or colour—and these are rephotographed in contact with coloured filters.

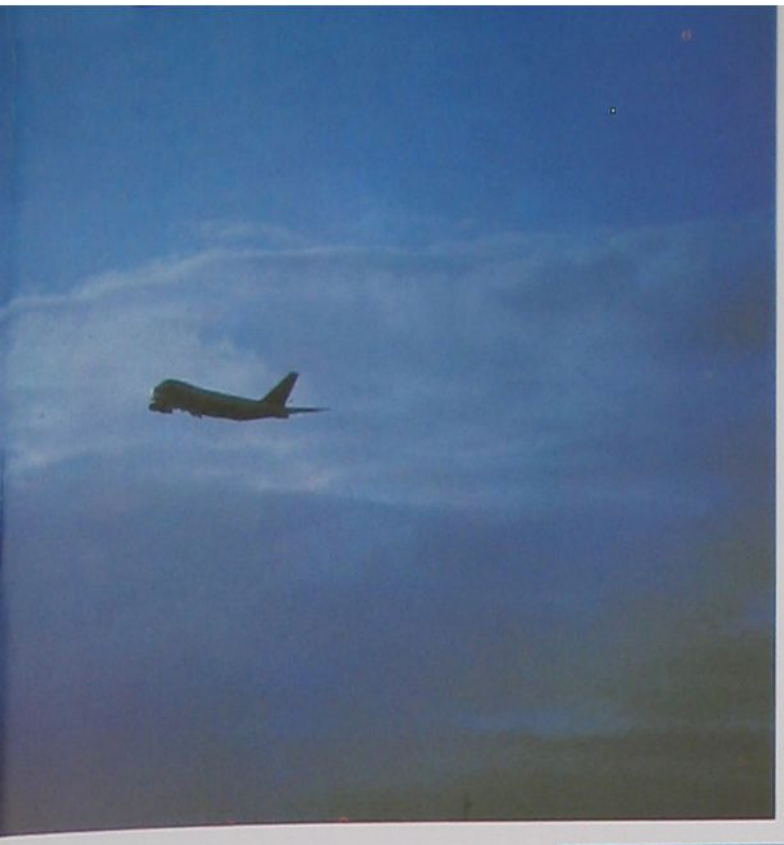
The separations can be negatives, positives or a combination of both. Registration is the major problem if complete accuracy is wanted. One solution is to tape the separations to the copier in such a way that they can be flipped in front of the lens in turn. You

Dave King/copier courtesy of Bush & Meissner

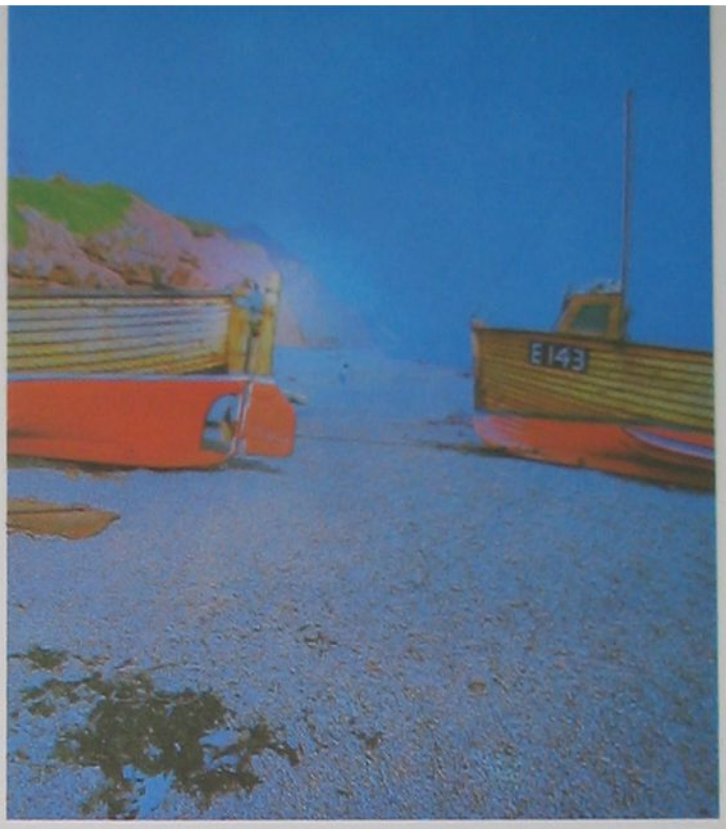
Handling slides *For maximum protection it is best to keep the pictures in transparent sleeves when sorting them*



Projected combinations *Images projected on to a screen can be photographed with a camera placed behind the projectors*



Sergio Dorantes



Tim Stephens

Richard Haughton

Moon shot *Adding the moon is best done using multiple exposure, which ensures that the highlights remain bright.*
Beach relief *This bas relief effect was created by combining a toned black and white mask with the original.*
Scapegoat *Combining pictures in a duper is the ideal way of producing surreal or fantastic images*

should make tests and experiment to find the best colour combinations and exposures. Exposures in particular are often difficult to judge. Generally you should follow the procedure for normal multiple exposures (page 513). But you should always bracket and try giving each picture being copied a different level of exposure.

When adding the moon to the landscape, for instance, you may find that the standard multiple exposure procedure gives a correctly exposed landscape but a moon which is too bright. To compensate for this you have to keep the landscape exposure the same while reducing the exposure for the moon. This is relatively easy if you are using a sophisticated bench-top copier. But with simpler equipment it requires some experimentation.

Projected combinations

One way of producing combinations without using a slide copier is to project the pictures on to a screen and rephotograph them. Two or more projectors are lined up so that the images overlap. Ideally the projectors should have identical light sources so that there is no difference in illumination between the various pictures. The best equipment is that used for A–V shows. In particular, a fade-dissolve facility allows you to control the image very precisely.

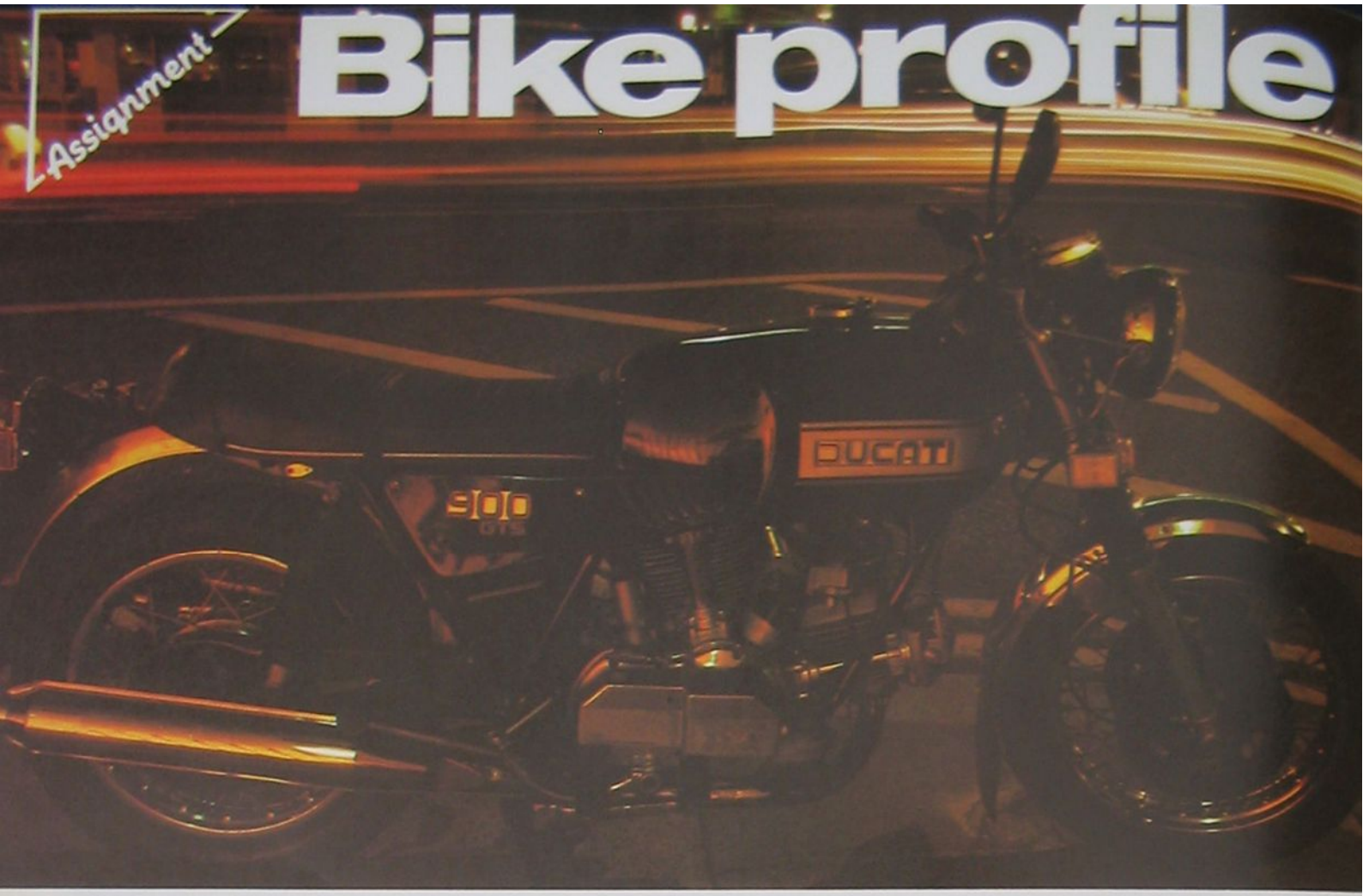
The camera should be mounted on a tripod, since the exposures are likely to be too long for hand-held shots. A medium telephoto lens is the most useful for this work as it allows you to shoot from behind the projection equipment and so avoids the problem of the camera getting in the way of the projector. Built-in exposure meters are adequate for determining the correct exposure, but it is better to use a hand-held meter, measuring using the incident method (see page 543). It is also advisable to bracket exposures by half stops to allow for uneven tone distribution in the image. Do not use too slow a shutter speed or the film will suffer from reciprocity failure giving underexposure and a colour cast. You should also remember to use artificial light film.

Slides can be projected on to white walls, draped fabric, white painted objects, the human figure, masks and so on. Some specialist photographic shops sell a range of materials designed for diffusing lights which can make unusual and interesting projection screens. Any part of a slide which is not wanted in the final image can be masked out using black card. The card is held in front of and quite near to the projector lens. In this way the edges of the card remain out of focus.

Whichever method you choose for combining pictures it is important to spend some time on it. Only by experimenting can you find the technique which best suits the type of image you are after. With just a few basic pictures you can produce a wide range of images and once you have gained some experience in this type of work you can also start to shoot various pictures with combinations in mind.

Assignment

Bike profile



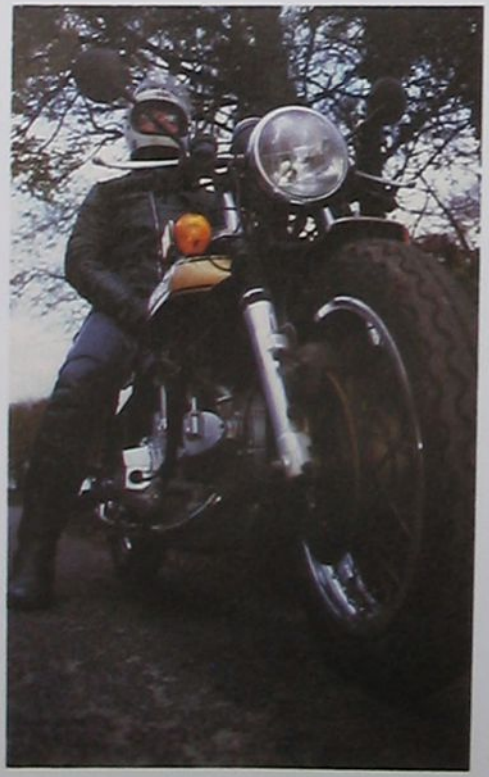
Motorcycles and photography are two interests which are frequently combined. Photographer, Ian McKinnell has a personal interest in bikes so we asked him to show his approach to a short assignment

Keen motorcyclists invariably form close attachments to their machines—often to the point of wanting to photograph them to have a clear record to look back upon—perhaps years ahead when the machine has become a collector's item. A treasured motorcycle also may be photographed because it has become an extension of the owner's personality—perhaps unpredictable or spoilt, loud, powerful or totally unreliable! On a more practical level, an attractive shot of a bike can be a good way of advertising it for sale.

Although motorcycles are very exciting and attractive machines, when it comes to photographing them the task is not as easy as it might appear. Their shapes make it difficult to fill the frame without leaving something out—usually the handlebars or half a wheel.

On a more positive note, bikes lend themselves to close-ups, to action shots and to graphic studies of their styling. As a professional, Ian McKinnell was able to think of several different ideas for locations and techniques so that he could produce a varied set of pictures.

Deciding that a coastal resort town would offer the range of locations and backgrounds needed, Ian planned his day so that he would be able to use both morning and afternoon light as well making time for a few shots in the evening, using only artificial lights.



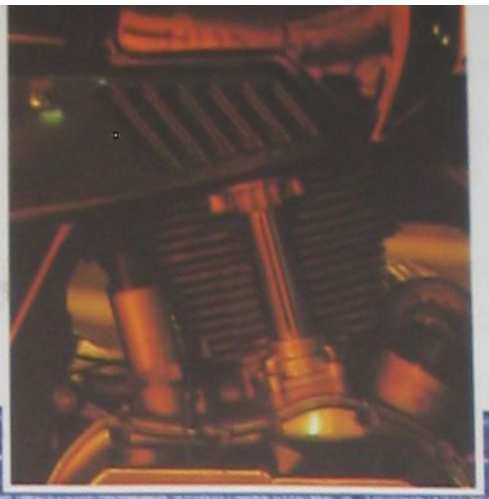
Bike and biker *This portrait of the rider astride his machine gained impact by using a wide angle lens from a low viewpoint, and also made it easier to fill the frame with both subject elements*

No attempt was made to include the entire bike in every shot. In fact, Ian deliberately framed some shots to show only a small section of the machine, leaving the rest of the picture area filled with the bright colour of a blue garage door. For this shot he used a 200 mm lens to allow this selective view and to flatten the perspective. His keen eye for exploring all the potential of a subject even extended to a wide angle abstract study of the bike's shadow.

An action shot of the bike at speed was thought to be essential. For this Ian employed several different techniques, including using a shutter speed of one second, to render the image a blur, and also using flash to make part of the picture sharp. He asked the rider to go past him slowly so he could try his hand at panning. He also lay down on the ground to get a worm's eye view of the bike coming towards him. Unfortunately, photographer and subject came a little too close to one another and a large leather boot brushed Ian's cheek sending his spectacles and Nikon flying into the air. Our hardy photographer survived but decided that he had done enough action photography and we moved back into town to try some night shots.

Back in town, Ian used the unnatural

Night portrait *The coloured lights illuminating a building gave an attractive hue to the bike. An exposure time of 20 seconds was needed (Kodachrome 64, 28 mm lens at f/8).* **Engine detail** *Ian used the same light source for a close up with his 55 mm macro lens.*
Blue door *With his keen eye for shape and colour, Ian set the bike in front of this garage door and framed only a small section of the bike*

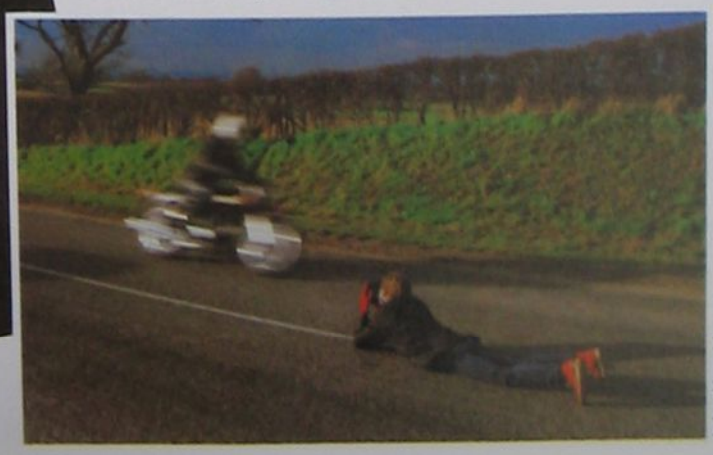


cast of artificial lighting to give an unusual appearance to his shots of the bike. The light reflected from a building illuminated by orange spotlights proved effective for this purpose. With the bike positioned in front of the building, Ian used a tripod to take his shots, exposing the Kodachrome 64 film for around 20 seconds. This exposure time also recorded the lights of the traffic passing in the background and added extra interest to the shots.

Ian McKinnell

Shadow *A 28 mm lens was used to frame just the shadow. Ian also tried a few other versions of the same shot which included the bike itself*

On the beach *An 85 mm lens proved useful for a portrait of the bike. The sea made a good background but demanded very careful metering*



John Heseltine

Action shot *For a dramatic action shot of the bike in motion, Ian bravely took to the ground, asking the rider to head straight at him. A flashgun gave a sharp image but the one second exposure also recorded the blur of movement—not a technique to be used by the faint-hearted*

Equipment for colour correction

The guesswork involved in using filters to give true-to-life colours on slide film in any kind of lighting can be avoided if you have a colour temperature meter

Dave King/equipment courtesy of Transworld Trading

Correcting for the colour temperature of lighting can be a headache for any photographer using slide film. But while it is not difficult to assess the approximate colour of the light source and take corresponding steps to correct for colour casts and balance with filters, it is all too easy to be slightly in error and still end up with spoiled shots.

Further, lighting conditions, particularly outdoors, can change so rapidly that while deciding which correction filter to use, you miss the shot. However, all this can be simplified and considerably speeded up if you use a colour temperature meter to take the guesswork out of assessment and have an appropriate range of filter types to draw upon, following the meter's recommendations.

Colour correction aids *vary greatly in price and complexity but they are indispensable under certain conditions*

Unfortunately, colour temperature meters are fairly expensive—on average about the same as a medium priced SLR—and even many professionals do without one. However the justification for buying such a meter largely depends on the kind of work you do. For example, where your shots have to be spot-on first time and the lighting conditions are likely to be very variable or unpredictable, a colour meter can soon pay for itself in terms of time and film saved.

Conversion or compensation?

There are two ranges of filter types which can be used to correct for colour temperature conditions which do not match the film you are using—*colour conversion* and *colour compensating* filters (see page 278). The difference between the two is that conversion filters, such as the 80A or 81B, effectively convert one light source into another by an overall change, while compensating filters, such as a 20M or 40G allow you to make small changes to each colour component of the light. They are much more versatile than conversion filters, but to give a range wide enough to cope with most situations, you need many more filters.

Every user of slide film should have a basic set of conversion filters. Unquestionably the most useful is the 81B, which is also known as a 'cloudy day filter'. Some photographers, however, use the milder version of this, the 81A, permanently on their lenses in place of the skylight or UV filter, to protect the front element of the lens. An 81A also helps to reduce the blue cast on flesh tones when using electronic flash.

Less useful for general work is the 82 series, though an 82B may be handy for occasions when the sun has a distinct reddish cast which you wish to avoid. An 80B is worth having, since it allows you to use daylight film in tungsten lighting, while an 85B does the reverse—it enables you to use tungsten balanced film (Type B) in daylight.

So a useful basic outfit would include an 80B, an 81B, an 82B and an 85B. In all cases the B filter of the series has a more noticeable effect than the A filter, so if you only want one filter it is probably better to aim for one that has a noticeable effect, to give you a greater range. Remember that the 81 and 82 series have equal but opposite effects, so the only result of combining filters from both series will be to cut down the light—just like a neutral-density filter.

Mireds and filters

Conversion filters can be given values on what is called the *mired* scale. The word mired—pronounced *my-red*—is short for *micro reciprocal degrees*. Any colour temperature has a mired value, found by dividing that temperature into one million.

The advantage of this is that a colour conversion filter can be given a constant mired value—for example, an 81B has a mired value of +27. This can be used to predict the effect it will have on a light

source of any colour temperature: it makes it redder by 27 mireds. Such a scale is useful because if there is very little blue in the light, an 81B will have a comparatively small influence on the blue proportion of the light—that is, it raises or lowers colour temperature less than when there is a great deal of blue around. For this reason, it is usual to convert both filters and colour temperatures to the mired scale. On colour temperature meters, this is in the form of *decamireds* (units of ten mireds) —the +27 of an 81B is rounded off to +30, and called 3R. A similar strength bluish filter, with a negative mired value, would have a value of 3B. But few photographers would ever bother to remember the equivalent mired values of filters and colour temperatures. This would require great powers of recall, because different manufacturers use different names for colour filters.

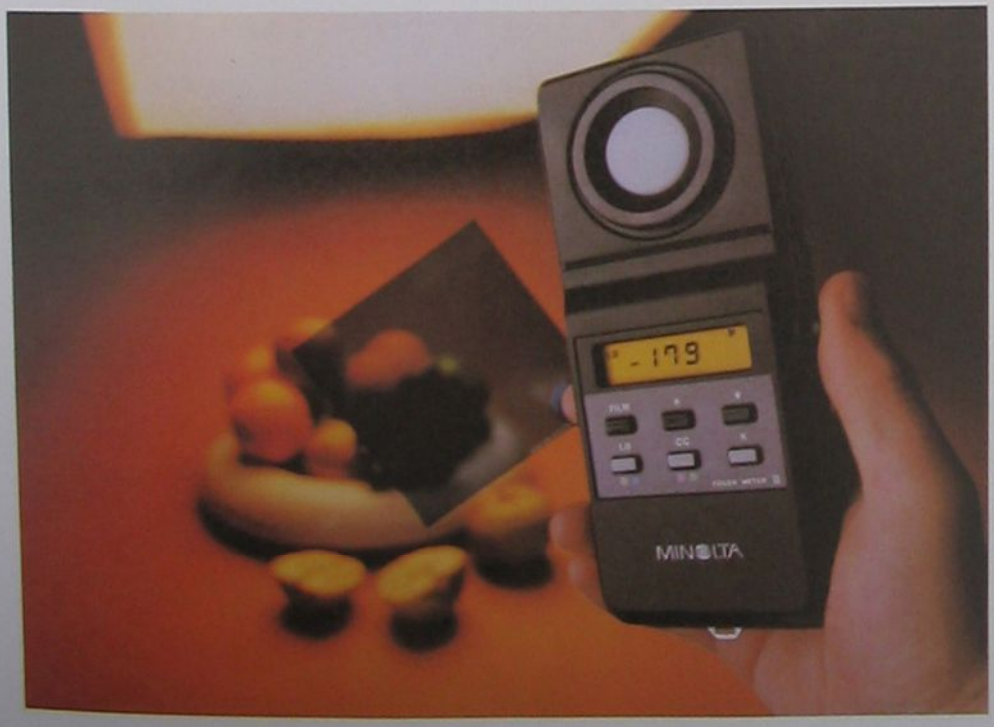
Colour compensation

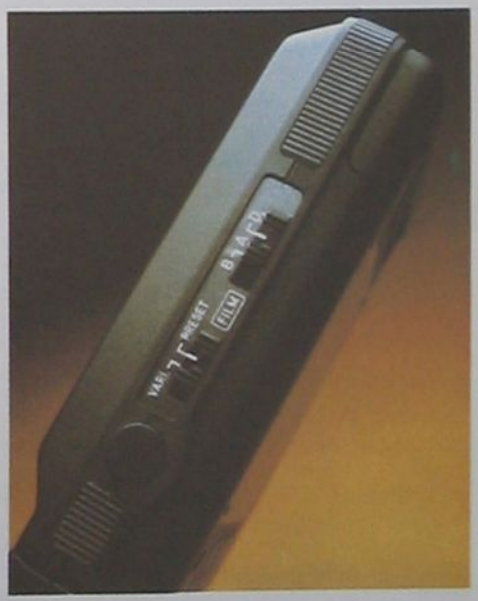
In the case of colour compensating (CC) filters, a basic kit is less easy to decide on. There are six strengths available in each of the primary and complementary colours, giving a total range of 36 filters. They can be used in combination, except that it is pointless to combine a primary with its complementary—that is, red with cyan, green with magenta and blue with yellow.

Using the Minolta Color Meter II *Select the type of film being used and press the metering button on the right hand side of the meter long enough for the reading to be recorded and stored in the electronic memory. The LB key is pressed to display light balancing filter values; the CC key for colour correcting filters and the K key for colour temperatures. Filter numbers are tabulated on the back of the meter*

CC filters are used to filter out individual colours entering the lens, unlike the conversion or light balancing filters, which are used to adjust only the overall colour of the light. They are equivalent to the filters used in the darkroom in colour printing.

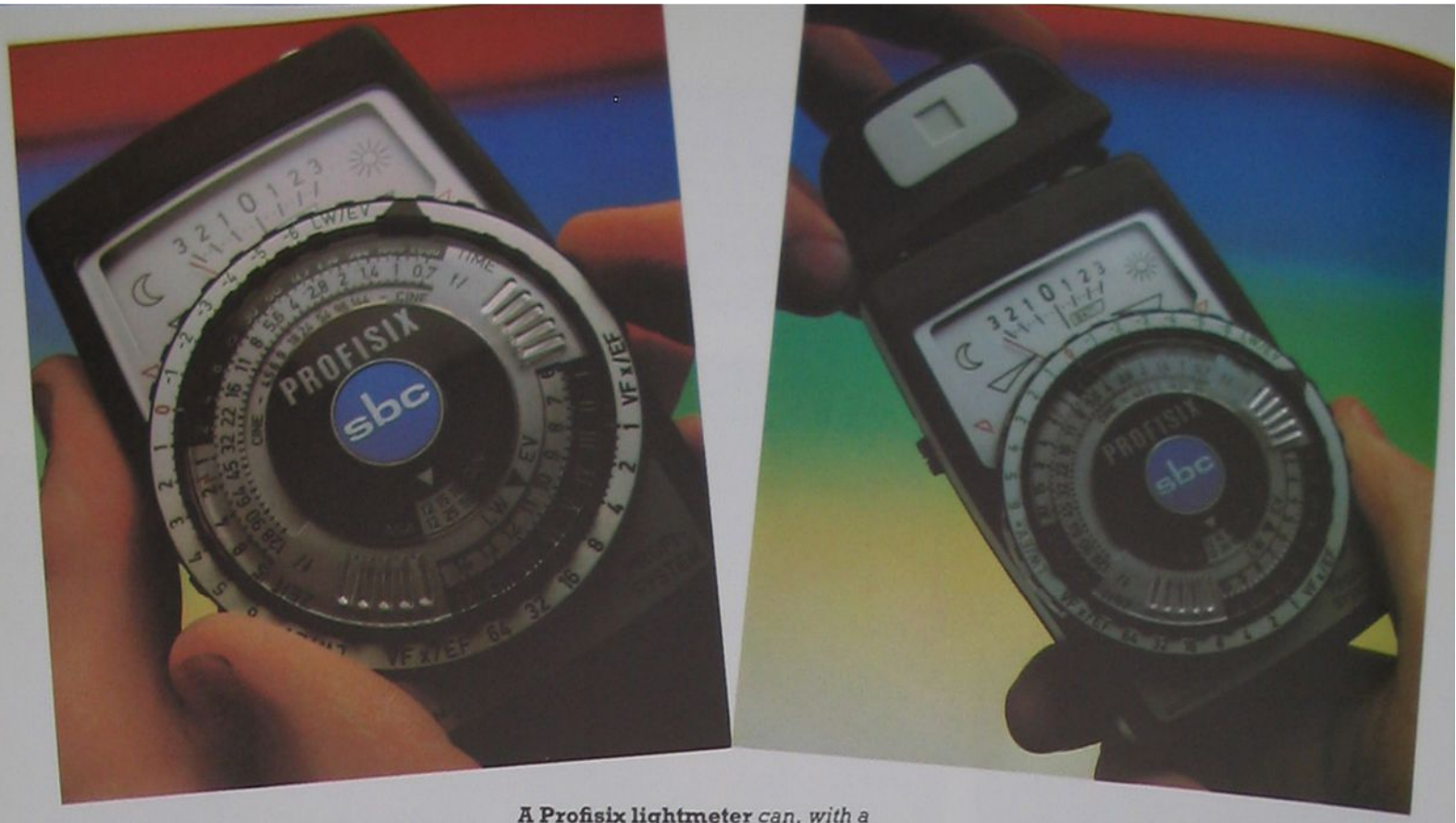
In practice, only green and magenta filters are usually needed if you already have a set of 80, 81, 82 and 85 conversion filters. They are needed to correct for the colour of such artificial light sources as fluorescent light and some street lights. It is also possible to buy conversion filters, such as the FL/D, which approximately convert fluorescent light to daylight. But even these filters are not the complete answer—ideally, a separate





Controls *for selecting film type and preset or variable colour temperatures, are a feature of most meters*

Example reading *The Minolta Color Meter II here gives a light balancing filter reading of —179 for daylight film in tungsten light, and indicates the use of a Wratten 80A filter*



compensation filter pack is needed for each type of fluorescent light. Although Kodak advise on the choice of filters for any given type of fluorescent tube, there may still be casts caused by such factors as the age or make of the tube. The only sure way to correct for such lighting is to take a trial series using the recommended filter pack, then make further correction if necessary.

Another use for colour compensating filters is to correct for known deficiencies of the film, such as colour casts resulting from the age of the film or from reciprocity failure effects. If you discover that a particular batch of film has, say, a cyan cast you can correct for this using a red filter—a CC 10R may be enough.

Colour compensating filters are usually only available as gelatin, which is comparatively cheap, but they must be used in technical filter holders (see page 577). Filters used for colour printing purposes may be suitable as long as their optical quality allows them to be used below the lens—which many cannot. A full set will enable you to correct for practically any colour imbalance that may be present—but to choose the filters which match the light source, you must rely on experience, manufacturers' guidelines, or a colour temperature meter.

Colour temperature meters

Most colour temperature meters work simply by metering red and blue light separately and then comparing their intensity. The simplest, most popular and least expensive meter on the market, the German Gossen Sixticolor, illustrates the principle well.

The Sixticolor has two selenium cells, needing no battery. One cell is covered by a blue-green filter and the other by a red–orange filter. The outputs from both cells are fed to a meter in opposition to each other. So when the proportions of red and blue light are equal, the meter is exactly balanced and gives a zero reading. But if there is a greater proportion of one or the other the needle will be deflected, giving an indication on a scale of decamireds which can then be converted into filter values. It also has a straightforward colour temperature scale.

The Sixticolor measures colour temperature from 2600K to 20,000K—a range which includes at the red end the light from a 40W domestic bulb, and at the other end the bluest outdoor daylight, in which the subject is lit only by a blue sky with the sun behind a cloud.

When using the meter, there is no need to adjust for light intensity—it reads in all normal lighting conditions. First you set the film type, rather than speed—daylight, photoflood or tungsten. Then you point the meter directly at the light source, and note the meter reading in mireds—it will give a filter value of up to 21B units (indicating that a bluish filter is needed) or 24R units (a reddish filter). A table supplied with the meter gives the appropriate conversion filter, or pack of CC filters, for each reading. There are differences between the reference numbers used by Kodak, Agfa and some filter makers, so the tables are essential.

It is also possible to convert the Gossen Profisix light meter to read colour temperatures. The Profi-color attachment includes a meter cell and dial which clips over the normal light metering scales.

A Profisix lightmeter *can, with a simple attachment, be converted into a colour temperature meter*

The Profi-color *attachment clips on to the Profisix, and a colour calculator is placed over the scale*

Filters *Light balancing filters are available in shades of either blue or yellow, but CC filters are more varied*

Filter equivalents

Different manufacturers use different names for colour correction fiilters. Here are some approximate equivalents (Agfa filters are not exactly the same strength as others).

Decamired	Wratten	Agfa
R1.5	1A	CTO 1B
R3	81B	CTO 2B
R9	85C	CTO 8B
R12	85	CTO 12B
B3	82B	CTB 2
B12	80B	CTB 12

Basic conversion filters for different film types

Lighting	Film	Filter
daylight	daylight	none
	type A	85C
	type B	85
photofloods	daylight	80C
or QI	type A	none
	type B	81A
domestic	daylight	80B
tungsten	type A	82A
or floods	type B	none
warm white	daylight	82B+20M
fluorescent	type A	85C+20M
	type B	81EF+ 81C+20M

Minolta Color Meter II

A much more elaborate and expensive meter, the Minolta Color Meter II works on the same basic principle as the Gossen Sixticolor, but instead has three cells, covering red, green and blue parts of the spectrum, and uses microelectronics to compare their outputs and give a reading. It has a switch to program daylight (5500K) photoflood (3400K) or tungsten film (3200K), but can also handle any other setting. Nevertheless, some films usually balanced at 5350K might actually be balanced at 5350K. So if you wish to take full advantage of the meter, you must test the film batch to establish its true bias, using the meter and a series of filter combinations on a test film.

Readings can be taken in kelvins, mireds (called light balancing or LB values) and CC filter values in decamireds. A scale on the back of the meter converts the mired values into Wratten filter descriptions, and CC decamired values into magenta or green filter numbers.

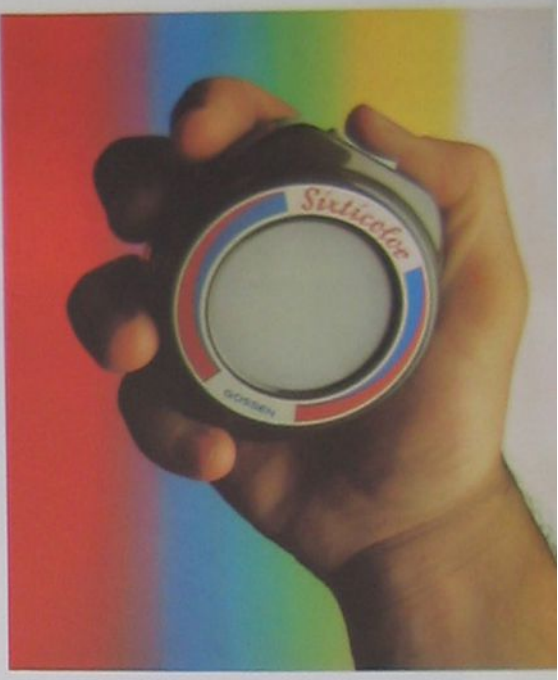
To use the meter, a button is pressed to select the type of film being used. Then a large metering button on the side is pressed for a few seconds to record and stabilize the reading—the liquid crystal display stays blank until the reading is computed and stored in the memory. You can then press the required function key for light balancing filter, CC filter or kelvin reading repeatedly, and the appropriate value will be displayed from the meter's memory.

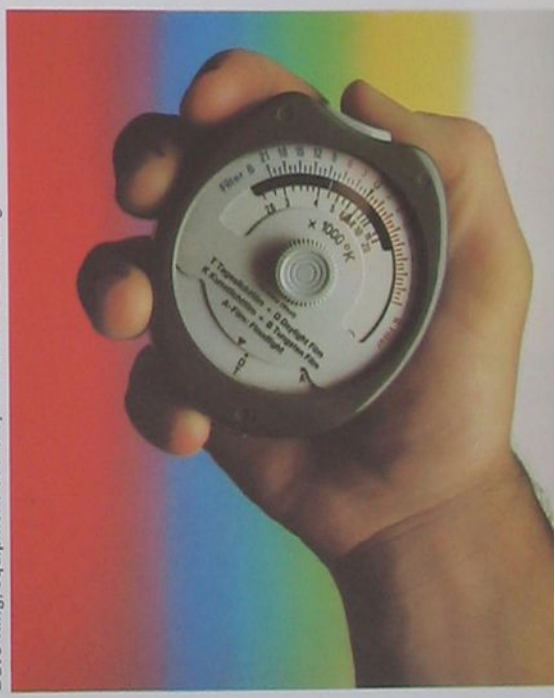
For example, a reading taken in a tungsten lit office with daylight (5500K) film was 3270K, –2 units CC, –123 units LB. The scales on the back indicated an 80B plus an 82 blue light balancing filter, and a 05G green CC filter. Factors on the scales showed an exposure increase of 2⅓ stops necessary with this filter pack.

In a room lit by fluorescent tubes with a magnolia painted ceiling, the reading was 4700K, +9CC, –31LB. This resulted in a filter pack of 82B plus 20M for daylight film, with one stop exposure increase. Switching to Type B film, the meter displayed +99 LB, +9 CC, which converted to 85C plus 81A and 20M: exposure increase was one stop. A colour temperature meter's readings are, however, likely to be inaccurate in any form of lighting which consists of a discrete line output (see page 199), and the readings may be untrustworthy.

A reading taken in bright, overcast daylight gave +15 LB and –2 CC at 6000K. The recommended filters were 81A plus a 05G CC. The 81A is the usual filter to 'warm up' an overcast day, but the 05G is unexpected. It was needed because red-brick buildings surrounding the subject reflected a high proportion of red light.

The Minolta Color Meter II is the only popularly available meter of this type and will give readings for almost any film stock and light condition.





Dave King/equipment courtesy of Transworld Trading

The Sixticolor meter *records colour temperatures through a metering cell on the back of the instrument*

Filter values and colour temperatures *are read off the scale and the filter number is obtained from a table*

Pete Turner

Science fiction is one of this photographer's particular interests and its influence can clearly be seen in his work. Pete Turner can make the ordinary look most unreal

Monument Valley *Taken with a 20 mm lens, 1/60 sec at f/5.6*

In the world of commercial photography in which he works, Pete Turner and colour have become almost synonymous. For many years, Turner has been exploiting bright, highly charged colours to make his distinctive images in which his use of colour stands out.

His studio is perched nine floors up, over the Carnegie hall, in the heart of Manhattan. From this base, a stone's throw from Central Park, he travels all over the world for some of advertising's most prestigious clients.

As one of the world's top photographers, he is in a very privileged position—he can pick and choose the jobs he wants to work on, and is frequently given an open brief by his client. People come to him because they want a picture that has the unmistakeable Turner hallmark, and they rely on his knowledge and expertise to create a striking image with a minimum of supervision. But if a client has very specific ideas, Pete does not feel inhibited and is quite happy if he is asked to work to a specific layout: 'If the type and layout are already set, that's fine by me—I'm a designer as well as a photographer, so type and text are just like other elements of a picture.'

With such a reputation, Pete Turner is in constant demand and he can virtually pick and choose the assignments he wants to do. Usually, he looks for an assignment that is interesting pictorially and is rarely concerned about the nature of the product being advertised. He seems to have little time for people who see photography as a medium for political or social influence. For example, he has little compunction about working on a tobacco account, and is a smoker himself. Yet he has obviously given the subject thought:

'It occurred to me to turn this sort of work down, but ultimately, you can't buck the system. One way or another, they are going to finance your work. What's the difference between shooting a cigarette advertisement, and exhibiting your pictures in a show which is paid for by the tobacco company? Obviously, if someone came to me and said "Pete, I want you to go out and take a beautiful picture of a hydrogen bomb exploding, so we can sell it.", I wouldn't do it, but things aren't usually that clearcut. We live in a capitalist system, you can't get away from that, and it is difficult to know where to draw the line.'

His down-to-earth approach to his clients is mirrored by his attitude to the commercial use of his own pictures. He acknowledges that when a photograph leaves his hands, there is little that he can do to influence how it is used, cropped or captioned. Many of his pictures are lodged with *Image Bank*, an international picture agency, and he may not even see the final printed image. Often, this appears in a foreign language publication on the other side of the world. His attitude is markedly different from that of many photographers who feel that the photograph as they conceived it is inviolate, and that it should never be cropped, or used in any way that

Pete Turner/Annette Ponsford

changes its meaning.

'A few times, I've been a little upset when my pictures have been printed upside down, or the wrong way round and with text smeared all over them, but my basic feeling about these sort of problems is that magazines are here today and gone tomorrow, and you've just got to live with that—it's going to happen one way or the other.'

Turner's passion for photography dates back to childhood. 'I was born in Albany, in New York state, but I grew up in Toronto during the war years. I used to photograph the battleships in the harbour with a Box Brownie—they made terrific patterns.'

While he was at school, he worked as a photographer on the school newspaper, and then went on to the Rochester Institute of Technology to study fine art. He specialized in photography, and worked alongside Bruce Davidson and Jerry Uelsmann. Minor White was one of his tutors at the college.

Even before he went to Rochester, he was interested in colour photography and it was this experience, combined with his training at RIT, that secured him a position in the photographic section of the US Air force. 'I've spent a year of my life at over 50,000 feet,' he quips.

His commercial career gathered momentum with many commissions for

Pete Turner/The Image Bank

Statue of Liberty *This unusual shot was taken with a 105 mm lens, 1/125 sec at f/5.6.* **Fiord** *The pattern of a boat's wake used to great effect*

1910

Pete Turner/Annette Ponsford

Grand Hotel *Taken at Brighton, England in 1979. 20 mm lens, 10 secs at f/3.5*

Look, *Holiday* and *Esquire* magazines. Many of these commissions took him all over the world, and it is pictures from these trips which laid the foundations of his large archive of colour slides. From this library of images he draws the picture elements which he uses to build up the unreal scenarios for which he is best known.

Nevertheless, much of Pete's time is spent on pursuing his own private photographic interests, creating images not directly intended for publication. Despite their more personal origins, though, many of these pictures are later used commercially, frequently through the agency which handles his work.

He often succeeds in combining business assignments with a couple of days shooting for himself. 'I finance my own work by shooting pictures for clients. The two areas are quite separate in some respects, but one helps to stimulate and improve the other. If you learn how to photograph, say, beautiful lipsticks, or some other product, you learn how to control lighting, and other elements of the photograph. It keeps you in training, like a prizefighter, and when you go to do something to please yourself instead of a client, you do it that much better.'

Just as his commercial work spins off into what he does for his own enjoyment, Pete's other interests show up in the work he does for clients. He is fond of repeating how much he is influenced by science fiction—he worked closely with Spielberg on the film *Close Encounters of the Third Kind* and produced the poster and other stills. More recently he worked on *Battlestar Galactica* in a similar role.

Sequences in these, and other space films are often made up of several elements, each shot separately, and this closely parallels the manner in which Pete Turner himself assembles his pictures, making him a natural choice for such a job.

The science fiction influence is clearly visible in many of the pictures that he shoots for other clients—familiar freeway foregrounds disappear into distant, unearthly horizons, and this combination of reality and fantasy is exaggerated by the bright primary colours of the pictures.

The rich colour saturation is no accident and is achieved by using a technique which Pete pioneered. He deliberately increases the colour contrast by copying the slide on an *optical printer*—essentially an elaborate slide duplicator (see page 726). In this way, he is able to turn the rise in contrast—which most photographers regard as the bugbear of 'dupes'—to his own advantage.

The difference between Pete Turner's duplicator and its more humble cousins lies in the degree of control that he can exercise over the final image. Because he often combines several elements, each slide that goes to make up the final

image must be held in a precise, easily reproduced position. This is achieved with a calibrated sliding assembly that moves the transparency beneath the lens of the copier with great precision.

Pete regards the original photographs as the bare bones of a picture, much as film shot in a cine camera is only the raw material from which the finished film is crafted. He uses a movie film comparison to explain one of the reasons why he makes so much use of his optical printer.

'You wouldn't expect a filmmaker to circulate the original film that he shot for exhibition in cinemas. The original stays in a safe somewhere. It's the same with my pictures—the original transparency is too valuable to be loaned out for a printer or blockmaker to scratch, and it stays in my picture archive.'

The archival permanence of his pictures is very important to Pete Turner, and for this reason, he works exclusively on Kodachrome film. Kodachrome has the most permanent dyes of any film, and its colours should last for a century before changing significantly. Ektachrome can fade within 50 years, and colour negatives within three.

Twins *Papua New Guinea 1975. 55 mm lens, 1/60 at f/5.6.* **Umbrella** *Taken in Zimbabwe. 55 mm lens, 1/60 at f/5.6*

Mechanical face *These binoculars were facing Chief Crazy Horse Mt, Dakotas*

Pete Turner/The Image Bank

Since Kodachrome is now only available as 35 mm stock, this is virtually the only format of film that he uses. 'Occasionally a client wants pictures on a larger format, and then, of course, we can't shoot on 35 mm, but given the choice, we prefer to. We've tried other emulsions, but none of them have the same colour saturation or permanence.'

Pete's obsession with colour permanence does not stop at the original transparency; he is very concerned that the printed image of his pictures should last at least as long as he does.

Because he sells many of his pictures to galleries and private collectors, print permanence is a particular priority for Pete. The prints that he makes for the purpose of exhibition are produced by the dye transfer method, a complex, expensive technique that retains its colours longer than any other print medium. All the images that are made in this way are signed and numbered by him, and because he can oversee their production, he is able to maintain complete control over their final appearance. To him, this is far more important than the appearance of his work in, say, magazine reproduction.

With a dye transfer image, he has control over the cropping of the image. He comments, 'I don't know of anybody who is going to take a chopping board to a signed and numbered dye transfer print, unless they are a maniac!'

Besides producing permanent colour prints for sale through art dealers, Pete's commitment to photography as art manifests itself in other ways. He is part owner of the Space Gallery, in New York, which is run as a cooperative venture with his wife, and his close friend, Jay Maisel. The three of them use the gallery not just as a showcase for their own work, but also to exhibit and sell the work of other photographers.

Understanding...

Colour response-1

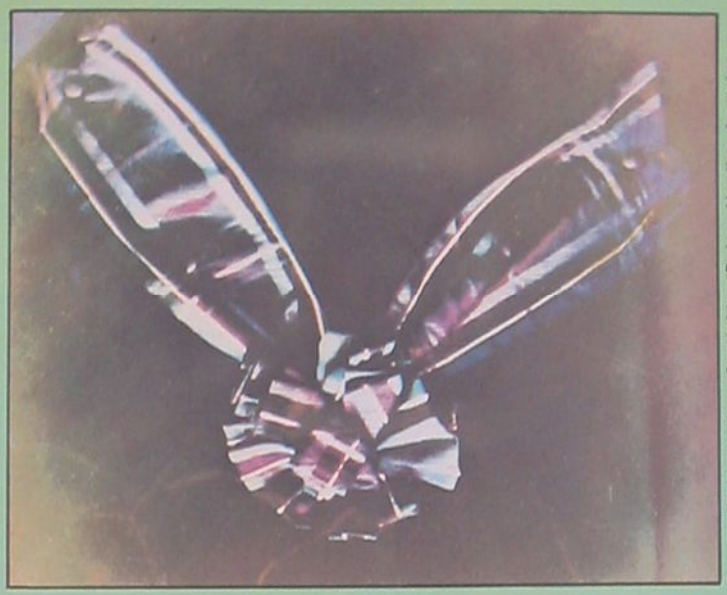
Modern colour film gives remarkably good colour in most situations, but certain deficiencies in colour response remain and these can be traced back to the very earliest days of photography

It is easy to fall into the trap of assuming that the colours recorded on film will be exactly the same as they were in real life. But even with the best colour film in ideal conditions, this is never completely true—there are always slight inaccuracies in colour rendition. For controlled colour photography, it is important to know just how accurately colours are recorded on film and just what the limitations are.

There is little doubt that the accuracy of colour reproduction has improved over the years and modern colour film actually gives very good colour in most situations. Yet it is, in many ways, surprising that it performs as well as it does. Although much more practical than the alternatives, the integral tripack (see page 550) has a number of drawbacks as a basis for accurate colour reproduction.

The basic three colour system of the tripack is at once its strength and its main limitation. Rather than attempting to record colours as they really are—that is, record the unique and precise wave pattern of every different colour—the tripack aims to record colours in terms of their blue, green and red content and then reproduce them using just these three colours. This *subjective colour* system is inevitably prone to slight inaccuracies—it depends on-on perfectly matching the original colour with a mixture of three different colours.

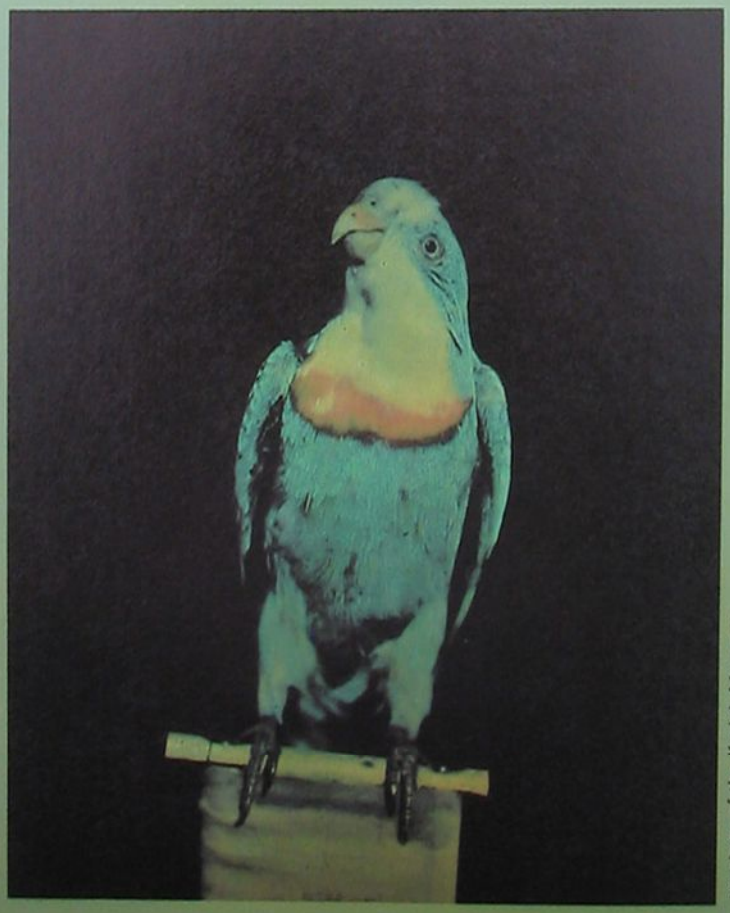
In the early days of photography, photographic scientists attempted to make *objective colour* photographs—that is, photographs that reproduce the wave pattern of every colour exactly. Unlike modern colour film, which depends upon chemical dyes, these early objective systems worked optically—rather than using the colour of the dyes, they used the coloured light from the subject. One system, put into practice by Gabriel Lippmann in the 1890s, depended upon optical interference—interacting light waves—to reproduce colour. Another system, devised at much the same time by F. W. Lanchester, involved a screen process and prisms to disperse light into a spectrum.



Cavendish Laboratory, Cambridge/Robert Harding Associates

The first colour photograph, *made by Maxwell in 1861, used the three-colour system—viewers saw three lantern slides projected together through blue, green and red filters*

Lippmann plate, 1899 *Objective colour systems such as Lippmann's, were theoretically superior and gave glowing colours but were less practical than three-colour systems*



courtesy of the Kodak Museum

Clearly, these systems, working optically rather than with dyes, and using objective colour rather than subjective, were potentially more accurate than the three colour system—the colours in the Lippmann plates were rich and brilliant. Unfortunately, neither proved practical. The Lippmann plate had to be set on a mirror viewed at precisely 90°, Lanchester's dispersion process required incredibly fine grained, slow emulsions. The subjective, three-colour system that we have today, therefore, was developed not because it recorded colour more accurately but because it was easier to use in practice.

Nevertheless, although three-colour systems seem in theory to be optically inferior to objective colour, this may not matter at all in practice. Colour seems to be only a sensation produced in the brain by the varying response of just three types of colour receptor, sensitive to blue, green and red (see page 856). If this is so, then there seems to be no reason why every colour cannot be recorded on film in terms of the same three colours. And apparently all that needs to be done to give perfect colour is to match the blue, green and red response of the film exactly with the equivalent sensitivities in the human eye.

Unfortunately, it is not as simple as this. First, because a perfect match with the colour sensitivity of the human eye does not necessarily give the best colour balance. Second, because it is much harder than you

might think to actually achieve this match.

One of the obstacles to achieving a perfect match between the film's colour response and that of the human eye is that no two people see colours in precisely the same way—indeed many people are blind to certain colours. Yet the differences in colour sensitivity between people seem small compared with the continual variations that every individual experiences.

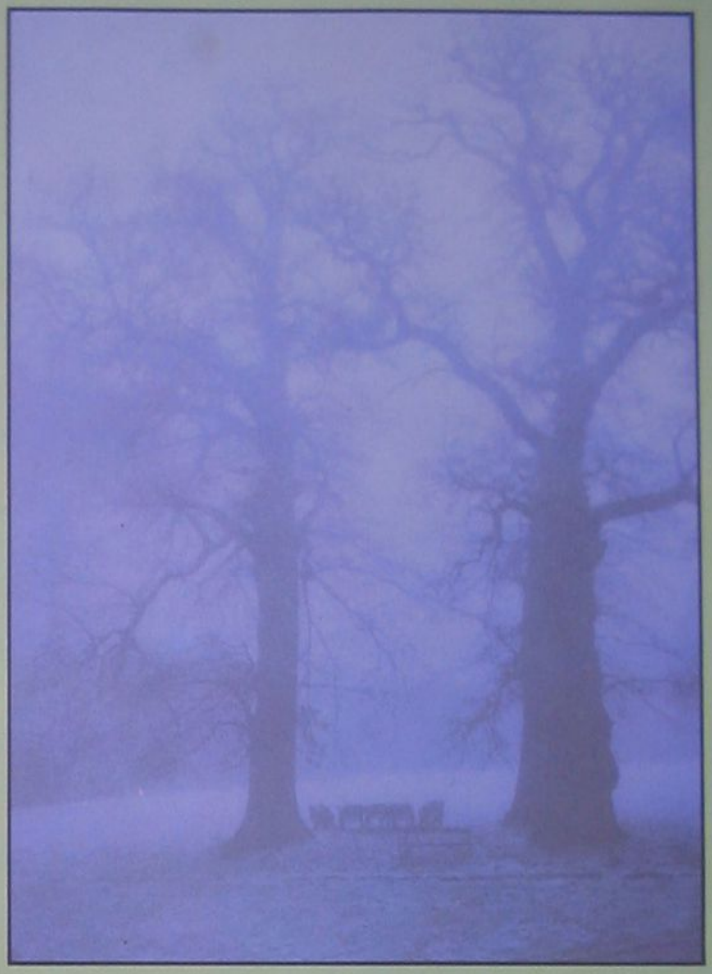
It is now firmly established that the colour response of the eye changes with the conditions. For instance, as the sun goes down and light levels drop, the colour sensitivity of the eye shifts towards the blue end of the spectrum (the *Purkinje shift*) and we see reds less and less well. As the light level drops still further, the cone cells in the eye eventually fail to respond at all and colour vision is lost (see page 822). On a bright day colour is lost in the shadows for similar reasons—when colour printing it is always better to allow any colour inaccuracies to occur in the shadows where they will be less obvious.

Variations in the colour response of the eye also occur when the colour temperature of the light changes—it quickly adapts to the colour of the light source (see page 857). It also adapts to any strongly coloured reflections so that we are rarely aware, for instance, of the strong green colour cast on the face of someone standing next to a bright green fence.

In view of the ever changing colour response of the human eye, it is difficult to decide what 'correct' colour is—is it how the colours really are? Or is it how we see them? For some scientific pictures 'real' colour might be more correct, but for most photography, the colours must be as we expect to see them. Unfortunately, unlike the human eye, a film can give only one colour response. Although separate films are made for 'daylight' and 'tungsten lighting', it is totally impractical to make a film for every situation. So the colour response of a film is necessarily a compromise. However, even this compromise can be difficult to achieve. To appreciate why this is so, it is necessary to look at the history of three-colour photography.

After experiments to prove that any colour could be produced by mixing blue, green and red light, in the 1850s, the young Scottish physicist, Clerk Maxwell, realized that a three-colour system could provide a simple basis for colour photography. With the aid of Thomas Sutton, he went so far as to make a demonstration colour photograph for a lecture as early as 1861, and the results of this experiment show some of the problems with achieving good colour. To produce the picture, Sutton made three separate exposures of a tartan ribbon, through violet, green and red filters, to give three separation negatives. He then made a positive slide from each of the three negatives and projected them in register on to a screen using a light source coloured by the original filters for each one.

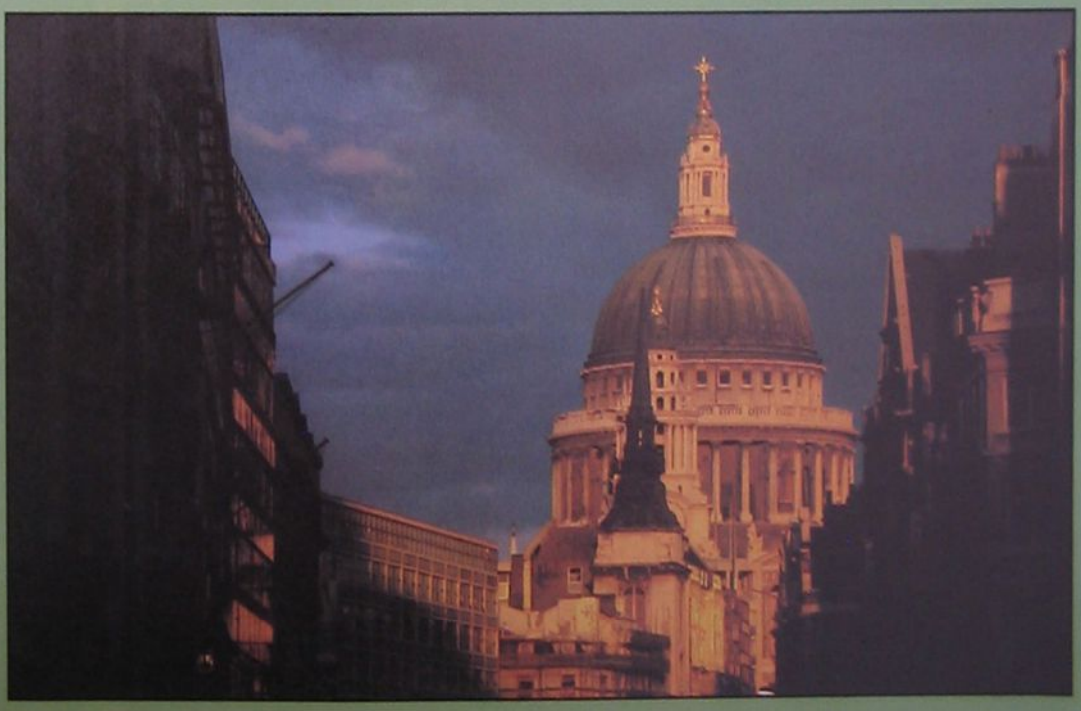
Although the results were fairly abysmal, Maxwell and Sutton's demonstration actually worked—and this baffled people for 100 years. At that time, the silver compounds in photographic emulsions were apparently only sensitive to blue light—so the plates shot through the green and red filters should not have recorded any image at all. Only in 1961 was it shown that the plates were in fact reacting to violet and ultraviolet light that the filters let through—it so happened that the red in the tartan ribbon reflected extra UV. Subsequently, UV sensitivity has proved to be more of a problem than an advantage. (continued on page 1940).



Robin Seagell

Trees in mist *The eyes adapt to the extra blue light in the air in misty conditions but film cannot*

St Paul's London *Film often reproduces sunset colours as much redder than the eye sees*



John Farndon

Creative approach

Your neighbourhood

Many photographers believe that they have to travel far afield to find interesting subjects when, in fact, stimulating picture taking opportunities may be found on their own doorstps

One of the greatest challenges for any photographer is to find interesting pictures in that most familiar of areas—your own neighbourhood. On holiday in faraway places, every back street, every wall, every roof seems interesting and worth photographing. The street where you live or work, on the other hand, may seem comparatively dull and completely lacking in picture possibilities.

Someone visiting your area from another part of the world, however, might find your neighbourhood fascinating, just as you find theirs. The difficulty lies in looking at your area with fresh eyes. There are very good reasons for doing so. The challenge will teach you more about photography, which will stand you in good stead when confronted with the unfamiliar. The pictures should reveal something about your area which you, as an insider, should be able to see better than an outsider. And the pictures can form an invaluable and worthwhile record of the area as it is now, which will be as fascinating in the future as old pictures are to us today.

One way of looking at your area with fresh eyes is to set yourself a professional style assignment, with a specific objective. Imagine that you have been asked to capture the spirit and appearance of the area for a colour supplement article, or to show people living on the other side of the world what life in your area is really like.

A professional faced with this assignment would spend a considerable time simply looking around, trying to get the feel of the place and noticing the age and types of buildings, assessing the people that live and work there, and choosing either typical or interesting examples. In some ways you have a head start, since you already know so much about the area and its population. But there is still a need for a good look around. Examine every detail and try to think of ways of using them in a photograph.

For example, unless you live on a

Anne Conway

From a window *Even a window view has potential. Here, the photographer chose a moment when the winter light invested the scene with atmosphere*

Locals *Your neighbours should also be considered as likely subjects—they will be familiar with you and so relaxed in front of your camera*

Bill Owens

Bill Owens

housing estate which was all built at the same time, it is quite likely that you will find buildings of different ages mixed together. You may not even previously have noticed that some buildings are considerably older than the rest and have survived later rebuilding programmes. Look for telltale signs such as the design of doors, windows and roofs as well as the obvious construction material. These features are ones that change most rapidly.

Even if you do live on an estate where all the houses are similar, small fittings and little quirks of design will make your estate different from those elsewhere, so look closely. If together they do not inspire you to make a photograph out of them, close in on them until they do. If the light is wrong, come back another day when it is. In your own neighbourhood you can do this easily. A plain brick wall can look good close up when the light is coming from the side. If there is a

West Coast suburbia *Photographer Bill Owen has been documenting his home area in Dublin, California, for years. These two contrasting views show the difference between a distant and an involved approach. The aerial shot shows a view which is seldom seen, and emphasizes the design of the roads and the repetitive, uniform pattern of the houses. Such features are less obvious at close range. But this gives a fuller idea of the way people live*

patch of moss or a smear of paint on it, so much the better—make these the ingredients of a colourful abstract that will still be recognizable. But while such details can often provide the most rewarding subjects for photography, do not forget to show the overall scene as well, or there will be no structure to your series of pictures—they will be merely a collection of apparently unrelated shots.

Look for peculiarities and differences. Try and remember what struck you when you first saw the area, and you may be able to transform the mundane into the interesting. Such details as the electricity and telephone wiring can often make all the difference to an area. In many places the sky at roof level is festooned with cables for these services, while elsewhere they run underground with the occasional box somewhere in the street for access. Even these are essential features of the area, which you only notice when they are changed. Street lamps, too, tend to be characteristic of an area, and the glass envelopes of the lamps can be intriguing when seen through a telephoto lens.

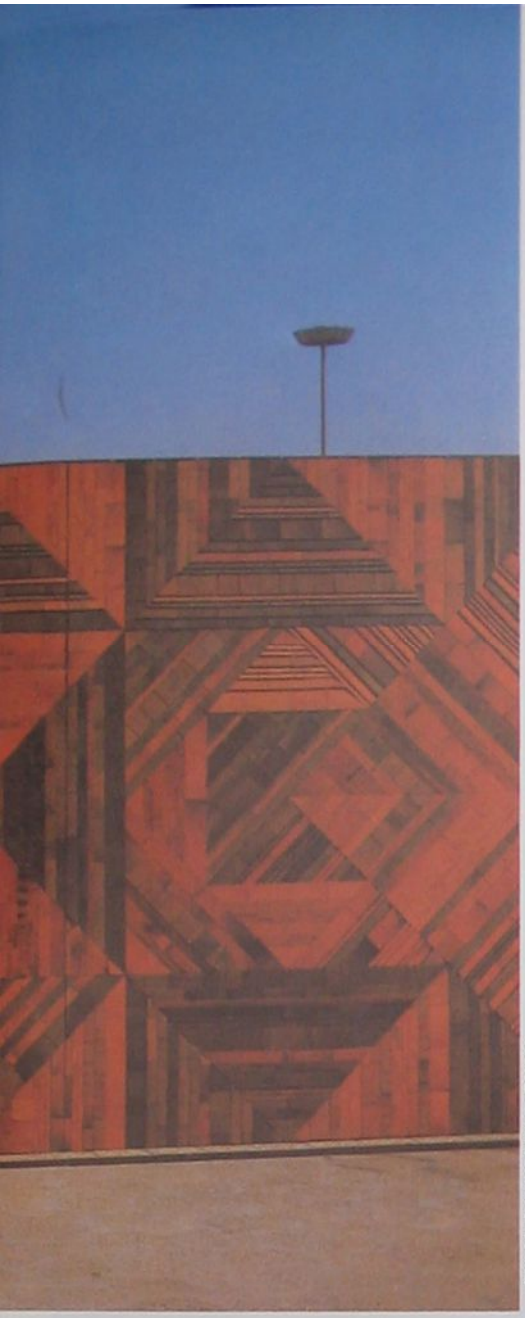
The very roadways and pavements can be worth photographing, particularly in older areas. Such mundane features as manhole covers frequently have complex patterns, and some people have made a study of the different variations that can occur in even a small area.

Photographs are often more impressive when presented as a complete series rather than as individual images. Your own neighbourhood may be an ideal place to build up such a series—not only are you more likely to be able to find the time to go out and take a few shots when the conditions are just right, but also your familiarity with the locality will enable you to notice details more readily. Windows, shopfronts, doors or door handles, gardens or abstracts are the sort of subjects which can offer enough scope to build up a series in a limited area.

A photoessay which gives a general view is easy if you live in a small neighbourhood, such as a village or small town, but if you live in a city you may find that the best approach is to decide to study just one particular aspect of the place. For instance, you can make an interesting essay on the area by exploring the people and the way in which they live.

There are many aspects of the people of a neighbourhood that are worth concentrating on. There are, for example that group of people usually described as 'characters'. To be fair, everyone has a character of their own, but some express their character more visibly than others and are better subjects for photography. One usually thinks of 'characters' as being elderly, but the young enthusiast cleaning his car, as he always does on Saturday mornings, or the harrassed housewife with three children in tow, both form part of the everyday scene and may be typical of the local population. A modern housing estate will have a high proportion of young people, while more sedate areas tend to have many retired people in them. Concentrate on these differences to reveal the character of the area.

Even over a matter of a few years the people change. Old people die, some



Daniel Barbier/Atlas Photo

Parisian cityscape *Inner city areas often include modern developments which provide graphic pictures, especially if you can include a figure*

Water pump *To photograph the local children, it may be worth looking for subjects around popular meeting places —like this water pump*

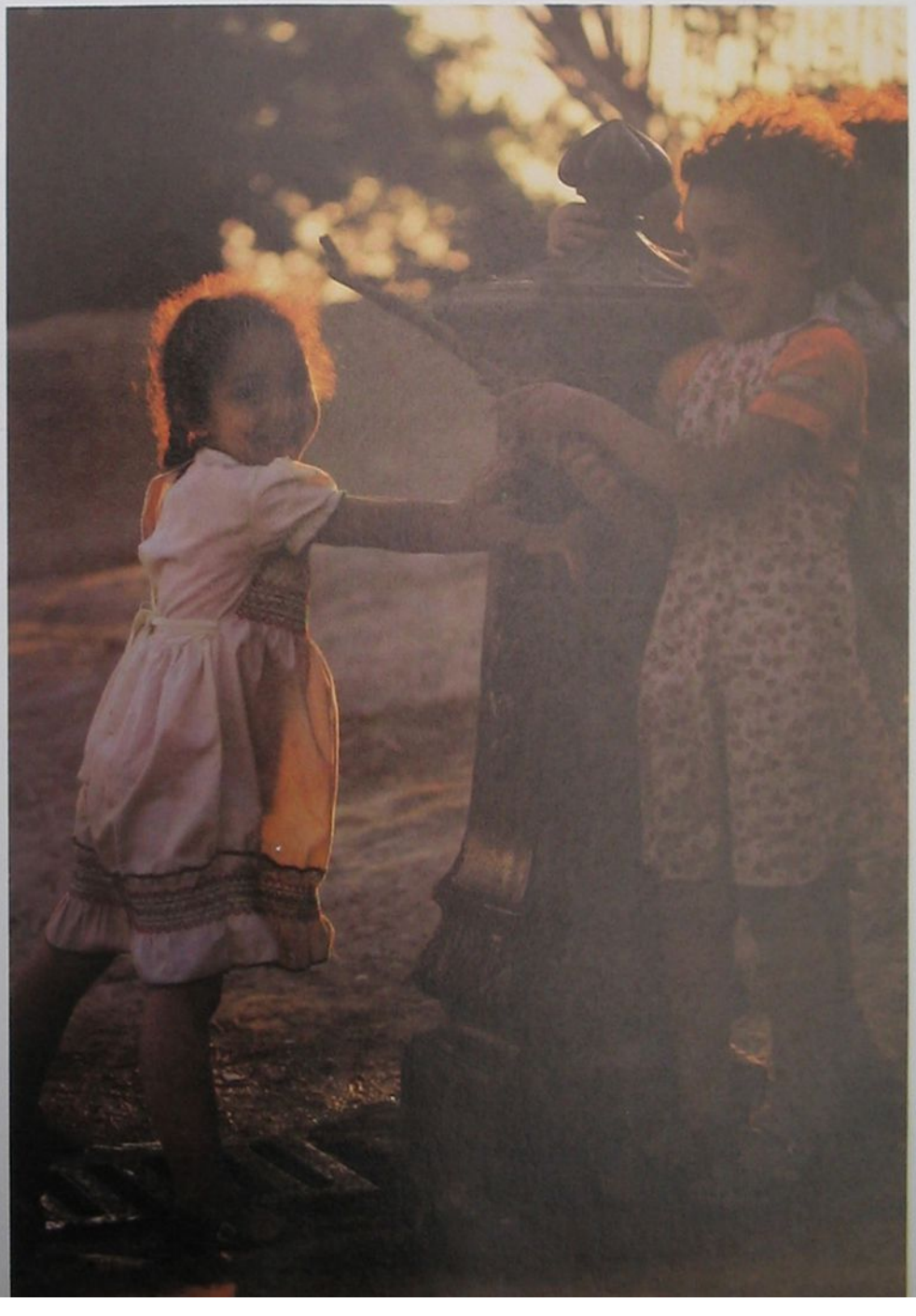
move away, others move in. Children grow up, and the notorious kid who terrorized every cat in the street soon becomes a well-dressed young man taking his girlfriend out to the movies. These are all subjects for your camera, either with or without their knowledge. While it can be very lazy simply to take pictures out of your window, with the same background and profile view, it would be justified if you were to mount all the prints side by side, showing the range of individuals or even, in the long term, the development of a youngster. This could be a project for which you use an old camera, permanently mounted so as to give exactly the same shot each time a subject moves into view.

It is worth remembering that a great deal of the interest in old photographs lies in the fashions that were current at the time. But consider how much more rapidly fashions and crazes change today. This is most noticeable with young people—even a year later their fashions seem quaint and amusing—but older people change as well. Crazes, too, will suddenly appear on the streets and will then die away. Some will be peculiar to your area so they will be well worth photographing as part of the changing scene of the neighbourhood.

In large cities, in particular, you will often find small communities of immigrants who have settled together and built up their own area in a very distinctive style. Whether they are expatriate British in India or Chinese immigrants in Los Angeles you will find that they have their own shops and cafés, clubs and churches. By concentrating on a small neighbourhood like this and returning to photograph it over several weeks, you may get to know your way around and make friends with the people there. You could extend this theme further by contrasting the people from two different cultures who live alongside each other. Or you might just photograph people of around the same age, lighting them in much the same way and posing them to emphasize their common background.

The American photographer Bill Owens made a book from his collection of family portraits in a small town. Each family was photographed in their own house looking directly at the camera. He used the same camera, lens and film combination each time in order to bring out the differences between the families, while retaining the feeling that they all had something in common.

A neighbourhood can also be portrayed by concentrating on the focal points of area—the shops, cafés and restaurants, for instance, where people meet one another. You could choose to photograph one café as it reflects the neighbourhood and its activities during the course of the day. Early in the morning you might find workers from a nearby market having breakfast, and by mid morning you could see a group of



Anne Conway

shoppers stopping for coffee. At lunch-time the local office workers might fill every seat, hurrying in and out before their lunch break is over, but later in the afternoon it is likely to become quiet, most customers being people with time on their hands, the retired, or possibly students whose lectures have finished. In the evening the place may assume yet another character, and in this way the mix of people that make up a neighbourhood can be illustrated.

Following on from this theme you could photograph a day in the life of an entire street, photographing perhaps with a wide angle from a single viewpoint to show the various activities that occur during a typical working day.

One of the most interesting themes which takes a different perspective on the neighbourhood is one which shows how things change over a period of time, whether it is a redevelopment scheme over a period of years, or simply the seasonal changes which alter the face of an area. On the other hand, a quaint village street which is about to be changed by the positioning of an adjacent motorway can be recorded in a series of 'before' and 'after' pictures. A careful viewpoint with a telephoto lens can make the motorway appear to be almost on top of the village, threatening its small existence.

Even on a smaller scale, such a treatment has its value. Things change everywhere, and often without warning. The old tree that has to be felled because it was struck by lightning, the distant view that is now blocked because someone built an extension to their home—all these are points to consider when taking your photographs. Bear this in mind as you look round, and try to identify such features so that you can record them while they survive.

But while much of this involves straightforward record photography, strive at all times to make the pictures good ones in their own right. When taking a view down the street, for example, do not simply stand in the middle of the road and press the button. A moderate wide angle lens will help to include some nearby objects as well as showing the view, so position yourself so as to make a mirror feature of something—a hedge, an attractive gatepost, or the framing branches of a tree perhaps. Alternatively, you might crouch right down at pavement level so that its texture serves to provide some interest rather than simply being a bland, featureless expanse in the lower half of the picture. Choose a good day with the light in the right direction and with a few clouds in the sky to provide interest in what would otherwise be another featureless area. Having selected your viewpoint and lens, you can choose the lighting conditions whenever they are just right—maybe a year will pass until you get the right combination, but you will have the satisfaction of having taken a shot in which you have exercised all your skill to make it so.

Adam Woolfitt/Susan Griggs Agency

John Sims

Geoff Howard

Newcastle street *This neighbourhood is juxtaposed with the city as a whole. The golden light romanticizes and softens the harsher side of the industrial scene.* **Fire alarm** *Though this object may be of little interest to locals, it is the sort of detail which the photographer can use as a strong and interesting pointer to an area's character.* **Shopkeeper** *Local figures that you know may be more than willing to pose for you in their own settings.* **Washing** *In dull or rather cheerless locations, look for bright splashes of colour to enliven your shots and break up the monochrome effect.*

The final difficulty with photographing your own neighbourhood—and for some people, perhaps the main obstacle—lies in persuading yourself that it is worth doing at all which raises questions about why one takes pictures at all, but there are several possible motivations for photographing your own neighbourhood. You can do it as an exercise in photography, with no thought of showing the pictures to other people or for exhibition. But if your pictures turn out to be particularly interesting, then you could well find that you have material of exhibition quality.

Maybe your local library or town hall would like to mount a display of them. And there is also the possibility that others will be interested—your local history society, or authors writing books about the area. As the years go by, your growing documentation of the life and people of your neighbourhood could become a unique and worthwhile record.

Processing for posterity

If you are meticulous in your normal processing routines, your pictures are assured of a lengthy life. But there are additional steps you can take to ensure archival standards of permanence

No photograph lasts forever and even if they never disappear altogether, all negatives, prints and slides deteriorate and fade with time. For most pictures, the fading process is very slow—providing they are properly stored (see page 560) —but if you have any black and white pictures that you want to last not just for your lifetime but for that of your children, you may wish to try *archival processing*—literally, processing for the archives, or posterity.

You can improve the permanence of your images simply by adopting a particularly meticulous approach to the normal routines of negative and print processing. In general this means using still active, untainted chemicals, particularly for fixing. To ensure the latter, use a fresh stop bath, and fix your film in a two bath treatment of fresh acid hardening hypo. Fix the film for half the total fixing time in each bath—if the total time is ten minutes, give the film five minutes in each bath. In each working session, the second fixing bath replaces the first and a perfectly fresh bath is used for the second. This ensures that the quantity of silver dissolved in the second bath is well below saturation point. To test whether the fixer is exhausted, you need to mix a stock solution—add 190 g of potassium iodide to 750 ml of water at 27°C, stir until dissolved and top up with water to make one litre. To test your fixer, mix five drops of this solution, five drops of hypo and five of water. If a white or yellowish precipitate forms, then the fixer is exhausted. The stock solution should be stored in a stoppered brown glass bottle—its shelf life is about a year. More convenient are the silver test papers available from laboratory supply houses.

Timing is very important—overfixing can bleach and stain the silver image, and too short a time can leave insoluble silver salts in the film emulsion. Agitation, too, is important, because you are removing substances from the film emulsion which can damage the image at a later stage.

Rinse your film for 30 seconds, agitating continuously, then repeat with fresh water. Follow this with two minutes in a hypo clearing agent. After this, give the film five separate one-minute washes, agitating continuously—the main part of the process is now complete.

If you are doing a great deal of archival processing, you can buy your chemicals in bulk, but throw away any working strength fixer after a month, even if you have not used it.

You are now ready to test for residual chemicals which will indicate that the film has not been properly fixed. Mix up a solution of two grams of sodium sulphide in 125 ml of distilled water and dilute this solution 1 :9 in water. This dilute solution has a working life of only a week, whereas the stock solution has a shelf life of about three months. For use place a drop of sodium sulphide solution on to an unexposed part of the processed film. If it shows signs of yellowing, you must repeat the fix and wash stages again, but a very slight cream tint is acceptable. Cut off the part of the film used for the test, to avoid contamination.

Once the film has been properly fixed, you can test for residual hypo. Dissolve 7.5 g of silver nitrate crystals in 750 ml distilled water, and add 125 ml of 28 per cent acetic acid, stirring carefully. This solution, known as Kodak HT2, should be stored in an airtight brown bottle, away from the light, and replaced every two years. To make the test, cut off a clear, unexposed corner of the film, and put a drop of the solution on it. Leave it for two minutes in normal room light, then blot off the excess. The resulting stain can be compared with a *patch test chart* such as the Kodak residual hypo estimator J11. This gives a very precise indication of how much hypo is left in the emulsion. Generally speaking, your film should show less staining than patch number one—this ensures that the level is a safe one for good image permanence.

The film can now be hung up to dry at room temperature. Choose a clean, dust-free room, and leave the film overnight if possible. Avoid heaters or hot air driers which can cause the emulsion to expand rapidly, with unpleasant results.

For long term storage, film should be kept cool and dry. Wrap films in best quality acid-free woven paper, and place them in airtight plastic boxes such as those used for food. It is also a good idea to buy an inexpensive hygrometer, to measure humidity so that you can keep it at optimum level. This should be between 25 and 30 per cent compared to the indoor average in temperate regions, of 40 per cent.

Dave King

Print posterity *One of the simplest ways of increasing the life expectancy of your black and white prints is to make sure that they are not 'overfixed' in overworked fixer solution. By using a system based on two fixer baths, this can largely be prevented. Avoid using aged fixer, even if its claimed capacity has not been reached—mark throughput on the storage labels*

Processing prints

Although it is generally simpler and more economical to preserve negatives and make prints from them as needed, you may want to put certain prints on permanent display, and they too require special processing for optimum stability. The best paper to use for permanence is fibre based material. Avoid resin coated paper, which is not as stable for archival purposes. This is especially true if the print is to be displayed in anything but normal room lighting.

When you make your print, allow a three or four centimetre border, as the time it spends in wet processing may produce split edges. You can always trim off the border when you have finished processing. Start by developing and stopping your print as normal, but it is essential to use absolutely fresh baths and clean trays. If any deposit forms on the trays, you can clean them out by scrubbing them with a ten per cent sodium hypochlorite solution and rinsing them thoroughly afterwards.

Use the same two bath fixing procedure as with films, rotating the baths in the usual way. It is not necessary, however, to test every time for exhaustion of the solution—it is sufficient to throw away the first bath after about 40 prints per litre have been fixed. Make sure that you agitate thoroughly throughout the fixing baths—if you do not, this may affect the stability of the print.

Once the print has been fixed and then briefly washed, it is ready for a bath in hypo clearing agent. This bath should be at 20°C, for two minutes in the case of single weight paper and three minutes for double weight paper. After the clearing agent stage, wash the print thoroughly for ten minutes, in the case of single weight paper. Wash double weight paper for twice this period. The faster the flow of water during the rinse, the more thoroughly the print will be washed.

Cut off two small pieces from the edges of the print, and make the residual silver test and the residual hypo test in the same way as for film. If the print passes these tests, you can use the hypo eliminator—Kodak HE1 is a typical formula. This reduces, by oxidation, the last traces of fixer left in the paper fibres. The formula contains peroxide, and must never be used for film as it can damage the emulsion and cause blistering for which there is no cure.

Prepare the solution by mixing 125 ml of three per cent (10 vol) hydrogen peroxide solution with 500 ml of distilled water. Prepare an ammonia solution by mixing one part concentrated ammonia (28 per cent) with nine parts distilled water. Add 100 ml of this solution to the hydrogen peroxide solution, and top up with water to make one litre. Work in well ventilated conditions when preparing this solution, and mix it just before you use it. It should be used in an open tray or container, and thrown away after use because it does not keep.

Use the solution at 20°C, and give each print six minutes with agitation in the bath. One litre of the solution is enough to process 13 prints 20 × 25 cm. Follow the bath with a ten minute wash, making sure that the prints do not bunch together, because this reduces the effectiveness of washing.

Once processed in this way, the emulsion should be extremely stable and chemical or physical changes will take place at a very slow rate. However, the image can still deteriorate in the atmosphere so it is worth toning the print.

Toning for permanence

One of the most damaging effects of the atmosphere is *bronzing* or ageing blemish, which is caused by the settling on the emulsion of sulphur in the air. This combines with moisture to form sulphuric acid. The acid eats into the emulsion, oxidizing the silver and causing patches and stains.

To prevent bronzing, prints can be sepia toned or gold toned. Sepia toning turns the image into silver sulphide, protecting it from sulphur in the air. Gold toning gives it protection without changing the colour of the image. There are a number of sepia toners available, both in kits and as formulae. All are suitable, but some are more complicated to use than others. One of the simpler ones is Kodak T52.

Kodak T52 consists of two baths. Mix solution A by dissolving 50 g potassium ferricyanide and 50 g potassium bromide in water to make one litre of stock solution. This is not diluted further for use. To prepare solution B, dissolve 200 g sodium sulphide in warm water to make one litre. This solution must be diluted for use, one part solution to 19 parts of water. Solution A is reusable, but solution B should be discarded after use.

Bleach the print in solution A, then wash until the yellow stain is removed. Tone it in solution B, then wash for two or three minutes. The result is a sepia toned print.

Gold toning prints

Gold toning involves plating the neutralized black silver, which forms the image, with a thin smear of gold—since gold does not react with other substances this makes the image very stable. The process is known as *gold chloride treatment*, and you can either buy a ready made kit, such as that made

By Courtesy of the Trustees, British Museum

Scientific exploration *Both pictures are reproduced from prints made from original glass negatives which were taken over a hundred years ago on the much travelled HMS Challenger expedition, shown at anchor in Bermuda. The other picture shows Mic-Mac Indians in Halifax. While both images have been preserved well because of diligent photography and processing at the time, the different state of the two images is clear evidence that storage, too, is important*

by Tetenal, or you can prepare it yourself using the Kodak formula GP1. The instructions supplied with the kit show how to apply the treatment, but remember that all the trays and tanks must be absolutely clean.

To prepare the GP1 toning bath start by mixing up a stock solution of one gram of gold chloride in 100 ml of distilled water. Add 10 ml of this solution to 750 ml of water in one container. In a separate container, dissolve 10 g of sodium thiocyanate in 125 ml of water. Pour this solution slowly into your container of gold solution, stirring briskly. This mixture is the solution used for gold toning.

Leave the print in the gold toning bath, at 20°C, for ten minutes, with agitation, then wash for ten minutes. It should be dried slowly, in the same way as film, avoiding heaters or dryers and, in a dust-free, fume-free room. Room temperature is ideal, because the chances of the emulsion stretching or contracting out of shape are reduced.

If films have to be stored in conditions which are warm and moist—far from the ideal—it would be a good idea to treat the negatives with a proprietary fungicidal antistatic agent before they are sealed up for storage. The same agent can be used for your day to day films to lessen the problem of damage and marks caused by attracted dust particles.

Specially manufactured acid-free paper folders and boxes can be bought to give your prints protection during storage, but cellulose acetate sleeves are cheaper. In addition, you can view prints without removing the protective covering.

Colour fading

Careful processing, handling and storage are the watchwords if you want to get the most from your colour photographs. But all colours fade in time, even if stored in complete darkness. Here are Kodak's figures for 'just noticeable' fading

Dye transfer prints	**300 years**	**Kodacolor 400 (C41)**	**10 years**
Kodachrome films (modern)	**90 years**	**Ektacolor 78 RC prints**	**8 years**
Ektaflex PCT prints	**60 years**	**Ektacolor 74 RC prints**	**8 years**
Kodachrome films (past)	**50 years**	**Ektachrome 2203 (R100)**	**8 years**
Ektachrome films (E6)	**50 years**	**Ektacolor 37 RC**	**8 years**
Ektachrome films (E4)	**20 years**	**Ektachrome Prof (E3)**	**6 years**
High-Speed Ektachrome (E4)	**20 years**	**Vericolor II (C41)**	**6 years**
Ektachrome 14 (R100)	**10 years**	**Kodacolor II (C41)**	**6 years**

These figures are based on storage under 'average' conditions—a temperature of about 24°C and relative humidity of 40 per cent. The colour changes which occur are very slight in the periods listed, but deterioration becomes much more severe in the years that follow. The lifetime of prints being used for display purposes can be lengthened by spraying them with an ultraviolet-absorbing coating (such as Kodak Colour Print lacquer, Matt) which also leaves the surface of the print with a matt coating that prevents unwanted reflections

courtesy of Kodak Ltd

This print was made from a negative which was exposed in 1962. The slight colour shift indicates changes which have occurred in the cyan dye layer of the negative—giving an image which is slightly warmer than it would have been normally. However, colours are still reasonably accurate

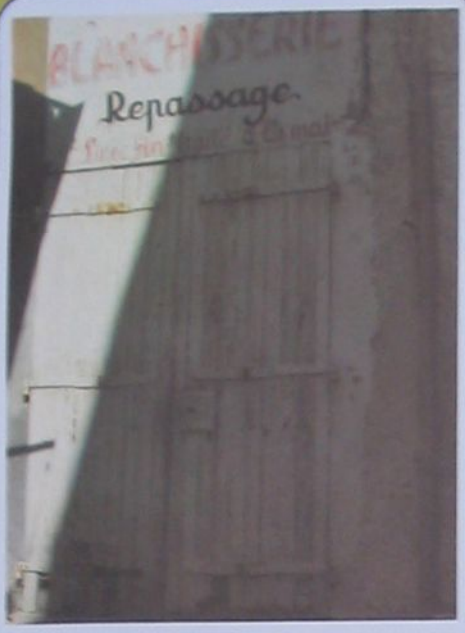
courtesy of Kodak Ltd

This sequence shows the effects of time on a colour print, compared with a newly made one (left). The centre print simulates 20 years of display in a home, under average conditions. The one on the right simulates about ten years of exposure to fairly bright flourescent light, such as found in typical modern offices

What went wrong?

Doorways

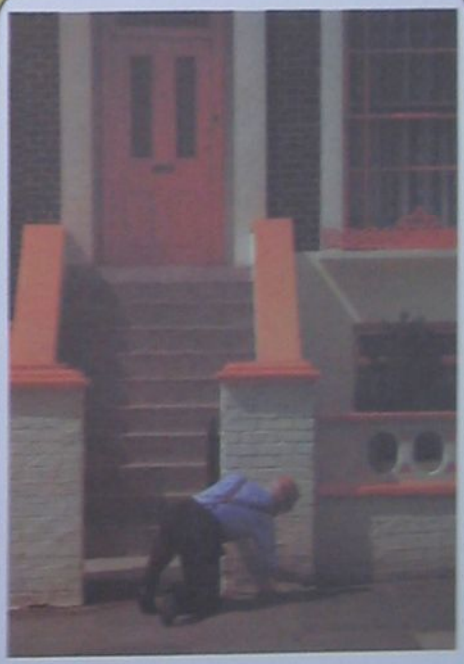
Doorways appear surprisingly often in pictures, and can often make photographs in their own right. Ian McKinnell gives his opinions on four very different variations on the same theme



Doorways present a rich source of material on both a visual and a symbolic level, but this image exploits neither aspect well. The elements it contains are all interesting but combined they detract from each other. The best elements of this picture—the play of sunlight and the texture of the old door—could be exploited better by moving in

For a photograph of a dynamic situation this is very static and looks posed. Why ? Looking closely we can see it is a woman's hand and the metal grille depicts a ballerina. Is a dancer on her way to rehearsal ? We will never know because we are not presented with sufficient information, and the image is not strong enough on its own. It looks as if it should be part of a sequence.

This image works on both a visual and a symbolic level, showing a doorway as a boundary between the real world and the imagined. The doorway, being in shadow, retains an air of mystery but being open appears welcoming. Such a scene, beautiful in itself, benefits from the simple approach used but might convey the idea of peace and harmony by moving in closer on the more interesting left-hand side of the picture.



This man is obviously obsessed with neatness and order—and so, it seems, is the photographer for the shot appears too 'tidy' and distanced, taken by a stranger with a long lens. A better shot would have resulted from going across and talking to the man who surely would be proud to have his house photographed. Then this could have been shot using a wide-angle lens giving the man more prominence yet showing more of his home and giving a feeling of intimacy.

IT'S DIFFICULT TO
SOAR WITH EAGLES
WHEN YOU
WORK WITH
TURKEYS
CAT

Improve your technique

Down the microscope

There is no need for highly sophisticated equipment for stunning microscopic pictures of the tiniest subjects. All you need is a basic school microscope, a suitable lighting rig and an ordinary SLR camera

The magnifying power of the microscope takes you into a weird and wonderful world, and opens up a fascinating range of subjects for the photographer. With just an ordinary camera and a basic microscope, you can make massive enlargements—up to 150 times life size showing such amazing detail as the tiny hairs on a bee's leg or the minute crystals of certain chemicals. Pictures like these are not simply interesting—they can often be remarkably beautiful as well.

Elaborate equipment is made specifically for photography with microscopes—*photomicrography*—but you can achieve perfectly acceptable results with any good quality camera. An SLR is undoubtedly the best type of camera to use, although almost any type will do, but none is as simple and convenient to use. This is because the best technique entails using the microscope in place of the normal lens and coupling the camera body directly to the eye piece of the microscope. The SLR is ideal not only because you can remove the lens and make this coupling quickly and simply, but also because the shutter is in the body of the camera and still usable. An SLR also allows you to see the view down the microscope exactly as the camera 'sees' it.

All the major manufacturers of systems SLRs make a light-tight adaptor which replaces the lens to allow for easy coupling to a microscope. Many microscopes are so substantially built that, once firmly attached, the camera often needs no further support. However, the weight of the camera can sometimes affect focusing simply because of the extra load imposed on the microscope focusing mechanism. This is particularly noticeable in photographs taken at high magnifications since small movements have a great effect on focus. So you may also need to mount the camera on a firm support, such as a copy stand, to prevent this mechanism taking the full weight of the camera. Apart from the microscope and the lighting system no other special equipment is needed.

Microscopes

Even the most basic microscope can give acceptable results—though 'hobby' microscopes for children should be avoided. Models designed for schools

The bee's knee *This picture shows the middle leg joints of a honey bee. You can easily buy ready-made slides of common subjects like this*

Basic set-up *The camera body, with the lens removed, is attached directly to the microscope. It is a good idea to mount the camera on a copy stand, to take some of the weight off the microscope focusing mechanism*

Dave King/copystand courtesy of Nikon UK Ltd. (Inset: Paul Brierley)

Setting up the microscope lamp

Focusing the lamp *With the lamp diaphragm stopped down, focus the image of the aperture on to the substage diaphragm by adjusting the lamp condenser or bulb*

Focusing the microscope *Roughly focus the image of the slide, using the objective–eyepiece combination which you intend to use for taking pictures*

are generally cheap and give satisfactory results and cost much the same as a good SLR.

The image forming system of a microscope has two major optical parts: the *objective* and the eyepiece (or *ocular*). Because it is important to know how big the image is, both are usually calibrated in magnification factors rather than focal length. It is possible to give such figures because the distance between the objective and eyepiece mounts is standardized. This separation is often referred to as the *drawtube length*. However, these magnification factors relate to the visual use of the miroscope and will not be accurate for photomicrography unless the film plane is located at about 25 cm from the eyepiece. At any other distance than 25 cm, extra magnification or reduction is introduced. So, if you need to know the exact amount of magnification you must usually focus the microscope on an object of known size—a graticule, (or stage micrometer) is used for this (see page 1968)—and measure its image on the focusing screen of the camera. Alternatively, the graticule can be photographed and its image measured later.

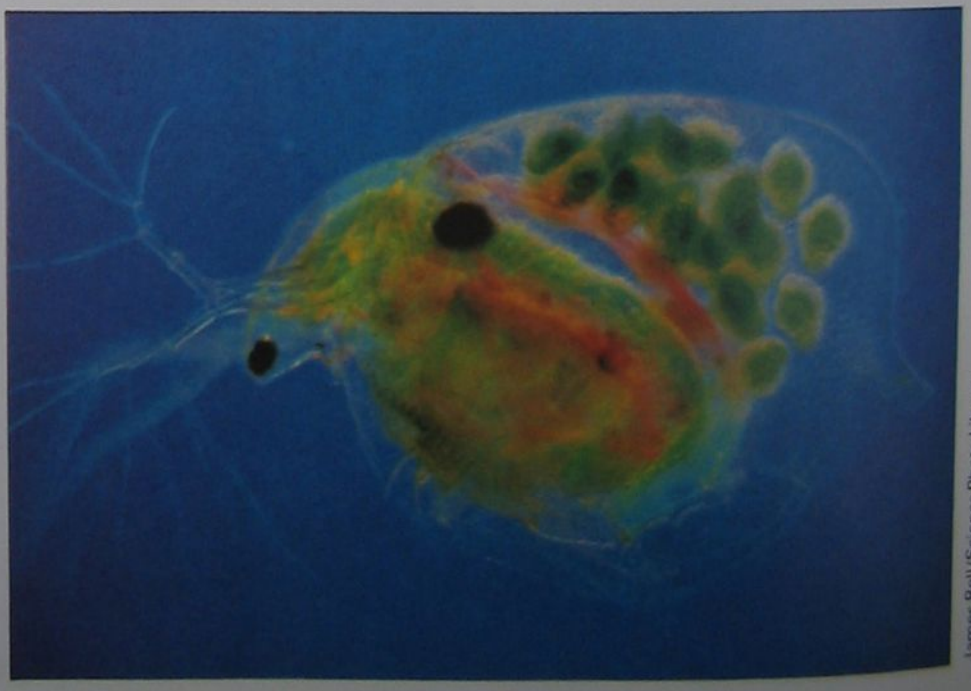
Like camera lenses, the optical qualities of microscope objectives and eyepieces vary considerably, particularly in relation to chromatic aberration. There are achromats, apochromats (see page 1406) and others, and it is important that the characteristics are matched in the pairing of the objective and eyepiece. In a camera lens, the aberrations which cause imperfections in an image have to be corrected as well as possible within the overall construction of the lens as a single unit. But in microscope optics, some residual faults in the image formed by a particular type of objective may be corrected in a matching type of eyepiece. So, if a mismatched pair is used, aberrations may not be corrected. Indeed, they may even be exaggerated.

A further limitation is that microscopes rarely have a high level of correction for curvature of field. If used for photography, they may give disappointing results since only the centre of each photograph is completely sharp. This can be avoided by using *flat field* objectives and eyepieces which are designed to give equally sharp images across comparatively large fields of view.

Lighting systems

Good lighting is essential for photography. In most photomicrographs the subject is lit from underneath. Unfortunately, few microscopes have built-in light sources and you must buy a special lighting system.

This system involves a special lamp rather like a small projector, which is used to direct a beam of light on to the centre of the mirror, where it is reflected towards the subject via a condenser system known as the *substage condenser*. The mirror can be adjusted to ensure that the field of view is evenly lit. The lamphouse has an iris diaphragm and the image of this is focused on to the plane of the subject by the substage condenser—you can see this when looking through



James Bell/Science Photo Library

Blue daphnia *To get these rich colours this live daphnia was photographed using polarized light and a blue filter. The magnification is × 100*

Condenser control *The next step is to adjust the height of the microscope condenser so that the image of the lamp diaphragm is sharply in focus*

Dave King

Diaphragm control *With the eyepiece removed, open up the substage diaphragm so that the light seen through the drawtube almost fills the rear element*

the eyepiece. If the lamp iris cannot be stopped down to make this process easy, then hold an object, such as a pencil, close to the lamphouse condenser to give you something to focus on. The lamphouse iris controls the area of the specimen that is illuminated and is easily set after it has been focused.

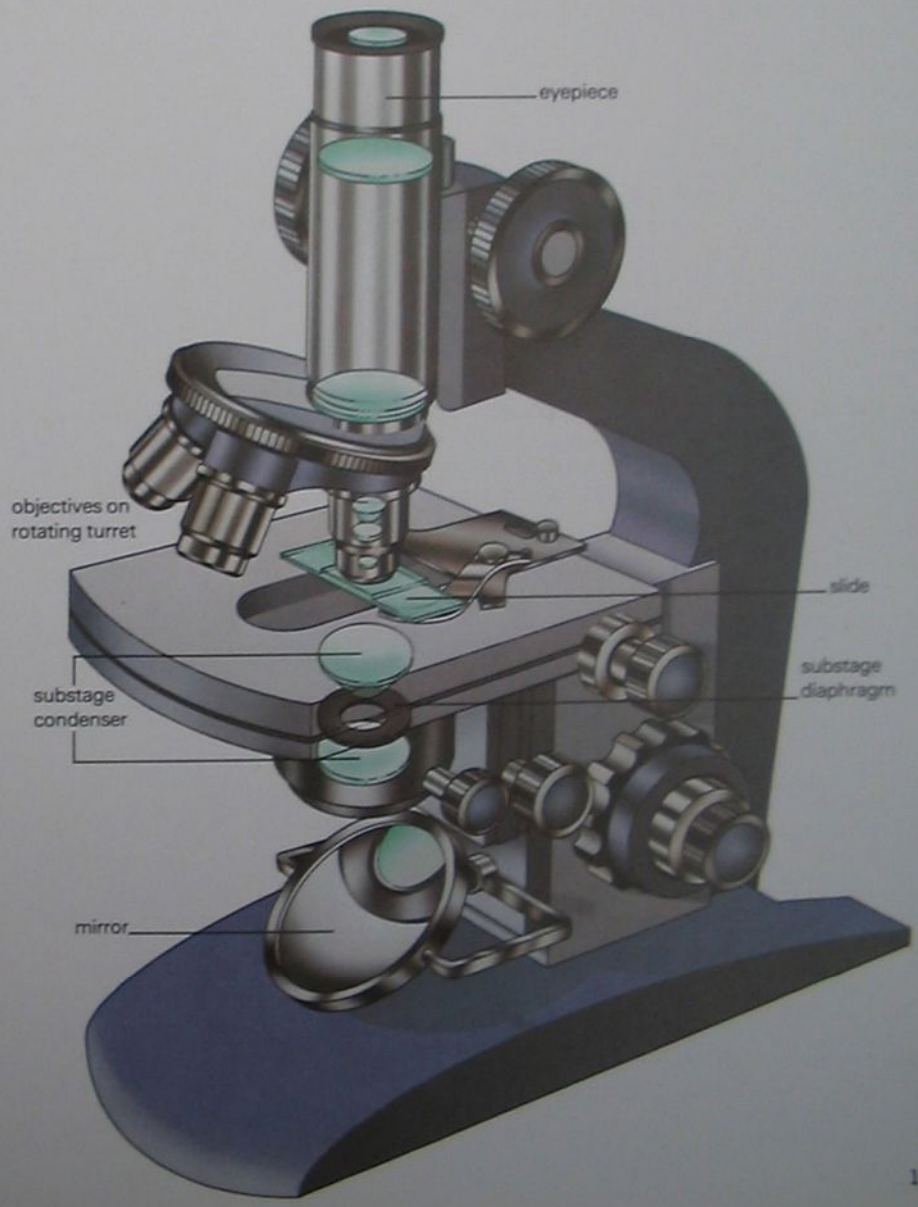
Once the lamp and substage condenser have been set up, the substage iris should be stopped down so that the cone of light which enters the microscope just fills the objective. This can be gauged by taking out the eyepiece and looking down the drawtube to see when the back of the objective is just filled with light. If the light cone is too small, the objective is effectively working at less than its maximum aperture and so is cutting down light unnecessarily: if the cone is too big, flare is introduced. In both cases, resolution is reduced.

It is important that there is a suitable mount for putting filters in the light beam before it reaches the specimen. This is needed because cross-sections of plants, animal organs and so on are often virtually colourless when first prepared. They are then stained (dyed) in order to clarify or emphasize certain features. But this staining is intended to make observation easier for viewing, and for photography, further control through filters is frequently needed if the subject is to show up clearly. In colour photography, filters are also usually needed to control colour balance.

Choosing the film

Because it is important to show as much detail as possible, photomicrography calls for film which is capable of high resolution. For black and white shots, a slow film, around 50 ASA (ISO), is best, though a medium speed (125 ASA) film

The main features of a microscope



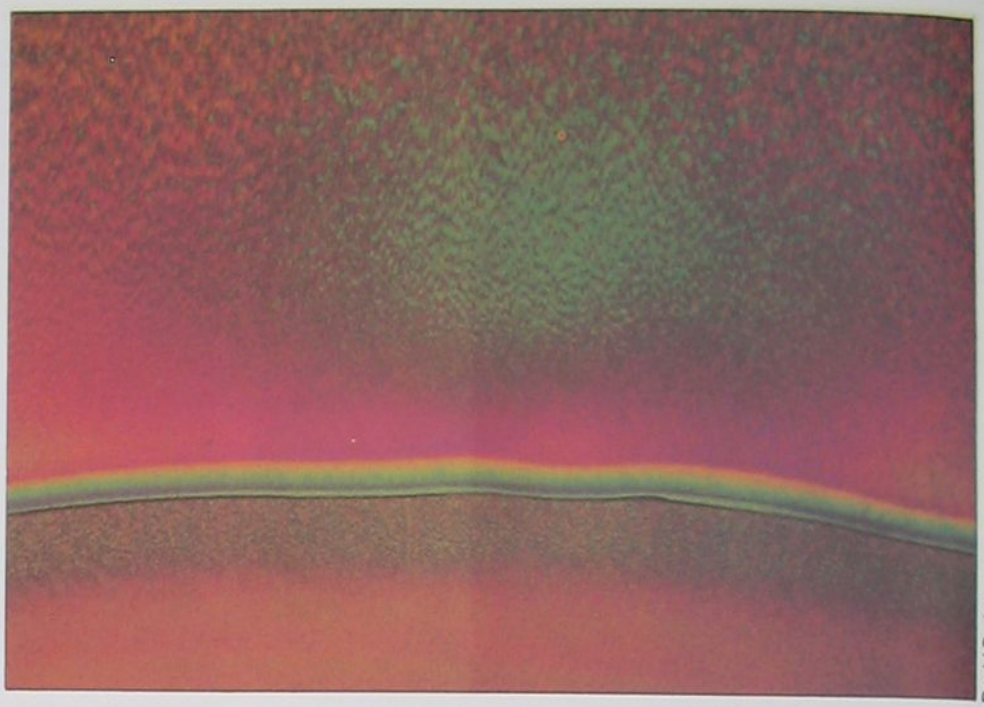
Alan Suttie

is acceptable if extra speed is needed. Most microscope lamps have bulbs with tungsten filaments. So if colour is required, any reversal film chosen must be balanced for tungsten light which means that the choice is very limited, though Kodak make a film specially for this purpose—Kodak Photomicrography Colour Film, type 2483. Even with films balanced for 3200K, some correction may be needed for colour temperature because of the particular characteristics of the system.

If you want to take colour prints, you have to use daylight film (none is available balanced for tungsten light) and it may be worth filtering the light to avoid too many problems during printing. A filter such as the Wratten 80B may be useful—but a great deal depends on the colouring of the subject and the precise effect wanted—experiment with different filters and test films to achieve the desired effect.

Preparing the subject

Specimens for microscopy are usually mounted in thin glass slides measuring about 25 × 75 mm. Although, with practice, you can learn to prepare your own slides, it is a skilled task and it is probably better to use commercially made slides at first—particularly where high degrees of magnification are involved. Because depth of field is very limited with photomicrography, it is important to look for the thinnest available slides.



David Parker

Instant record *If you simply want a record shot of a specimen, this Polaroid adapter is ideal. It is easy to use and gives instant pictures*

Lighting techniques

Two special lighting techniques are often used. *Darkfield illumination*, which is described in detail on pages 1650 to 1653, is very useful for colourless specimens such as crystals. But *polarized light* may also be used with this kind of subject and gives colourful and exciting results from apparently dull slides. For this system to work, one polarizing filter must be fitted between the light source and the specimen and another between the specimen and the film, usually at

Dave King/equipment courtesy of Polaroid

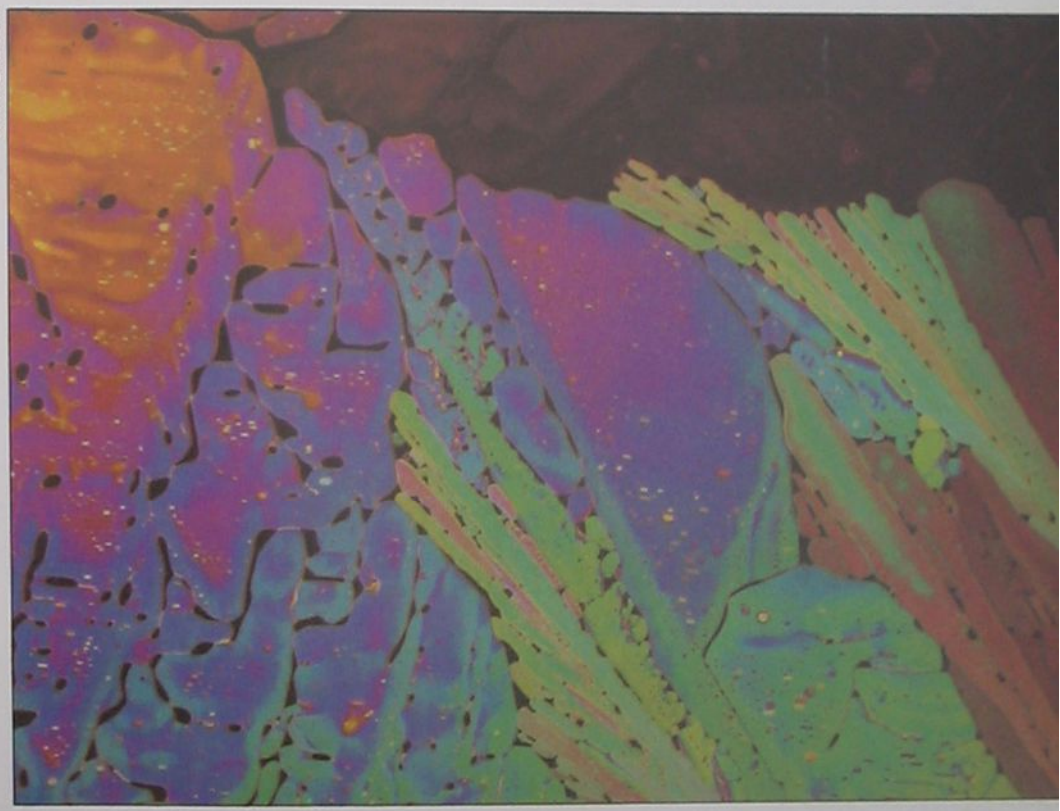
Chemical variations *These pictures show the dramatic effects which you can achieve by photographing even quite simple substances through a microscope. They were all taken using crossed polarizing filters, which help to produce rich and varied colours. The chemicals shown are ascorbic acid (left), Epsom Salts (right), hypo (below right) and even lith developer (below left)*

Paul Brierley

eyepiece level. The two polarizers are set to their crossed or extinction position so that no light passes through them normally.

But some types of subject such as borax or hypo crystals have an effect on the light—they are *birefringent* (see page 1030—which causes brilliant colours to be seen, the actual colours depending on the orientation and thickness of individual crystals. A good example is a drop of borax solution which has been allowed to dry out on a slide and is then photographed between crossed polarizers. The results, even with such simple subjects, are usually quite stunning.

At high magnifications the slightest vibration blurs the picture and it may be worth using electronic flash in place of the tungsten lamp for a brief exposure—



Wilf Woodhead

David Parker

using the tungsten light just for viewing and focusing. Because of the short duration of the flash, vibration has no effect on the image. Flash also has the additional advantage of allowing the use of colour films balanced for daylight. Lamphouses with built-in flash may be available, but it is relatively easy to make such a set-up yourself using a small flashgun. Tests should be made to find the best location for it and to find the correct exposure, as this is impossible to prejudge by normal methods. Cameras which use off-the-film (OTF) metering to control a dedicated flash (such as the OM-2) are most useful, as they automatically compensate for any light loss in the optical system.

Exposure

With tungsten illumination, exposure calculation can be difficult. TTL metering is not always accurate in this kind of situation. It is best, therefore, to carry out some experiments to find how the TTL system can be matched to this kind of work, by finding which film speed setting gives the best results with a particular film, ignoring the manufacturer's stated film speed. However, cameras which use OTF metering should give accurate results, when used normally on automatic, as long as you compensate for reciprocity law failure.

If the camera used has no TTL meter, then exposures will have to be worked out in some other way and an exposure meter is useful. Light readings are taken by placing the meter cell directly over the microscope eyepiece, so the most useful type of meter is that which has a large size cell. Once again, you must make tests to find the most accurate film speed settings.

Experienced, professional photomicrographers rely heavily on their accumulated experience and in one respect, their methods are useful to anyone who takes up this aspect of photography. They keep very careful notes of every aspect of their work—objective, eyepiece, filters used, microscope lamp details, special circumstances, and of course, exposure details. From a notebook containing this sort of information, it is often possible to relate current work to previous situations. And after all, if it is accepted that a particular purpose of photomicrography is to record with objectivity and accuracy, then such notes will be an essential feature of this absorbing aspect of photography.

Assignment

Shopwindows

As a photographic subject, a shop window poses many difficulties, some technical and some aesthetic. Clive Helm shows some of the ways around the problems

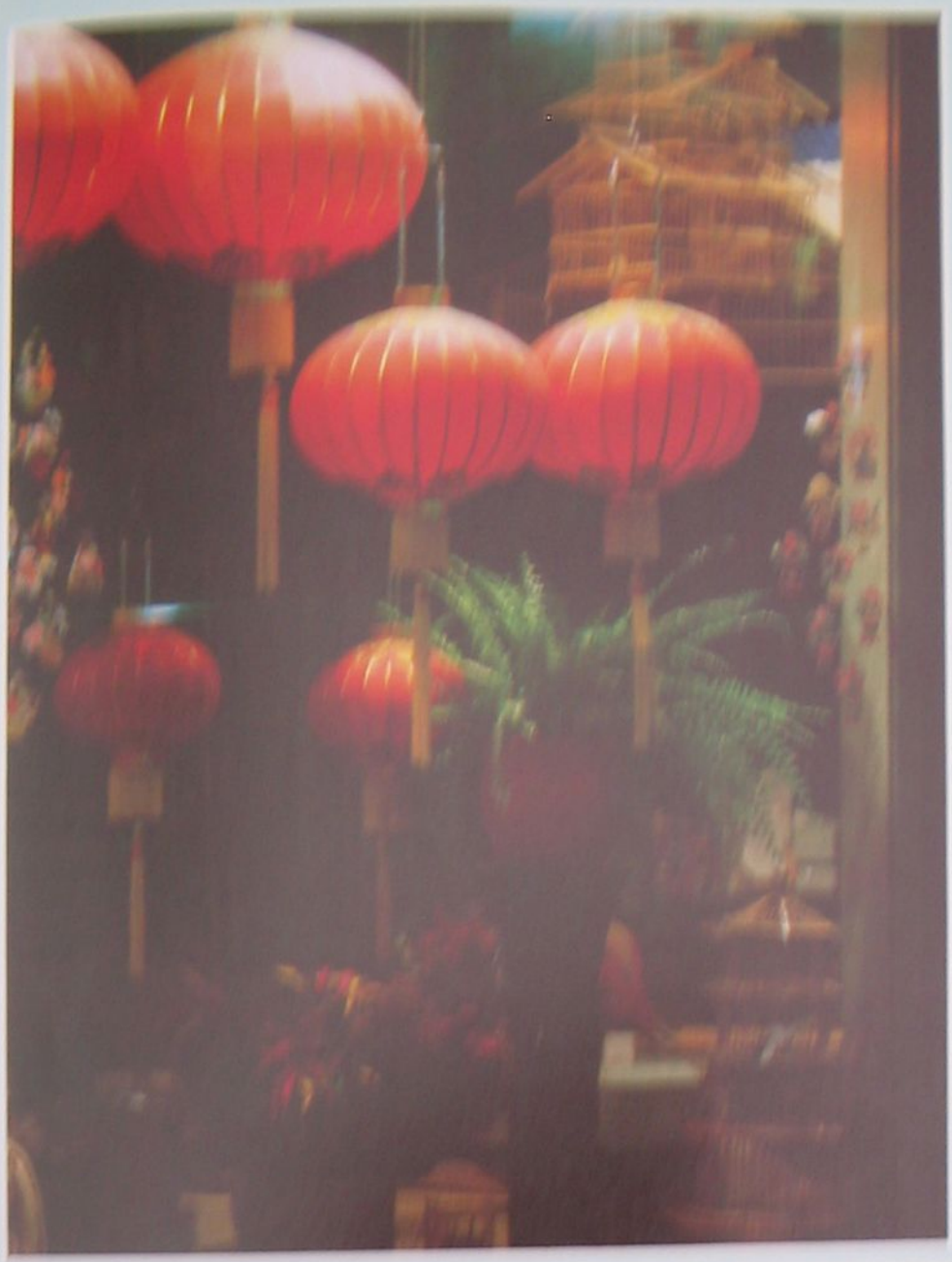
A request to photograph a shop window display is the sort of thing that any photographer could be faced with at some time or another. It may be in order to provide publicity for the shopkeeper, or it may be that the merchandise featured in the window is attractive enough to be of particular interest to the passing photographer.

However, this is the type of assignment that, although it initially appears straightforward, actually turns out to be fraught with difficulties. Reflections and obstructions are part of the problem, but the chief difficulty is finding a way of making the shots look as interesting as the 'live' window display itself.

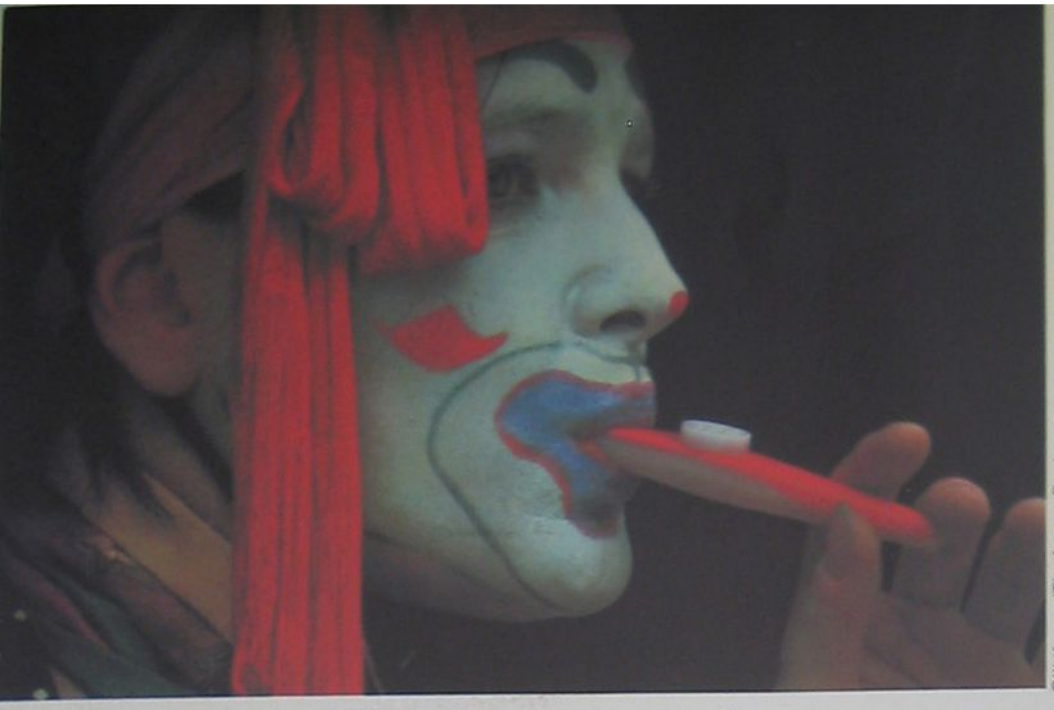
When Clive Helm arrived at the shop, he decided straight away that his shots would be best taken by standing well back and using a telephoto lens to close in on the window from the other side of the street. This eliminated any problems of converging verticals caused by using a wide angle lens at close range. He chose a 75–150 zoom on his Nikon FM so that he could frame the shot exactly.

Fan *Standing at an angle of about 45° to the subject solved many of the problems caused by reflections, but a polarizer helped even more—cutting down reflections both on the glass and on the objects behind it, so strengthening their colours. Clive also fitted an 81A filter to cut down the blue cast caused by using Ektachrome in the shade*

Working with Ektachrome 200 film and with his camera mounted on a tripod, Clive set about trying several different views of the subject. His photographs show how reflections can be minimized by shooting the window from an angle instead of head-on and by using a polarizing filter. He also took some shots at night using Ektachrome EPT film, which is balanced to cope with the tungsten lights used to illuminate the window display. The only problem with this is that a hand-held flashgun with an orange filter covering the tube has to be used to eliminate a cast.



Red lanterns *After dark, it is possible to photograph a window head-on because most of the light is on the other side of the glass. For all the night shots Clive used tungsten film which is balanced to suit artificial lighting.* **Bicycle** *This shot was deliberately taken to show what happens when a window is photographed head-on.* **Day and night** *Both of these shots were taken from angles of about 45° but in the daytime version reflections are still evident, even though a polarizer was used.* **Shop staff** *As well as details of the display and a full view of the window, Clive also asked the staff to pose outside to add a human element to the series*



Gill Kenny/The Image Bank

Creative approach

Circuses and fairs

Covering a range of subjects from candids, through action shots to abstracts, circuses and fairs present plenty of colourful material for creative photography

Both circuses and fairgrounds have a great deal to offer the creative photographer. There are bright lights, gaudy colours, excited people and constant activity, and another world to explore behind the scenes.

Sometimes there are publicity stunts to photograph and it is always worth shooting the setting up of the event if you can. The erection of the sideshows and stalls, the caravans and generators moving into place, and the raising of the big top for a circus set the scene nicely for the rest of your shots. Take your photographs from a variety of distances and viewpoints, or the series may lack the air of activity and anticipation that it should have. A sequence of long shots showing the gradual erection of the show could be interspersed with close-ups of the people working.

Of course, you must obtain permission to shoot if you want any close-ups: few circus or fairground people will appreciate people getting in the way at this exceptionally busy time. Try to make the acquaintance of some of the people involved—it may lead to some privileges such as being able to shoot behind the scenes later on.

For the circus show itself, both in travelling circuses and permanent arenas, it is the viewpoint more than anything which makes or mars your photographs. So it is worth going to considerable trouble to find the best position to shoot from. You are rarely able to move around during the performance, so your seat must be well placed. Get to the show early on the night or, if you can, go along to a dress rehearsal—during a rehearsal you can also look at the way spotlights are used and the timing and positioning of the acts and the musical introductions.

A clear, unobstructed view of both the arena and the high wire acts is obviously essential, but you must also examine the background for distractions—although you can throw it out of focus, you cannot remove it. In particular, avoid shooting directly opposite a spotlight—unwanted flare can often be a problem in circus shots—and from a position where the far edge of the circus ring will divide any shot neatly in two.

A point to remember is that, at many circuses, the performers play primarily

David Jamieson

David Jamieson

Clown portrait *The bright colours of a clown's make-up and headgear stand out particularly well against a dark background.* **Trapeze** *When photographing circus acts, try to shoot when the action is at its peak*

to the most expensive ringside seats opposite the ring doors. If you sit opposite these then it is likely that the performers will turn to face you more often. You will also get a clear view of the performers entering the ring and you may be able to use the ring doors as a clean 'framing' background. For close-ups of individuals, a ringside seat is clearly best, but for more general shots you need to be higher up and further back. Perhaps the best compromise is a seat two or three rows back, next to the gangway—the view is unobstructed and you may be able to stand up for occasional shots. A final point to bear in mind in your choice of viewpoint is the high wire—a seat anything but directly underneath, or close to such a point, will probably be unsatisfactory.

Circuses often appear to be brilliantly lit, but the overall light level is generally low, except when the show is being televised. So fast film and fast lenses are essential—the low light will make it very difficult to hand-hold any lenses with a maximum aperture of much less than *f*/3.5, unless you take a monopod with you—a tripod is too cumbersome.

Tungsten balanced colour film is obviously best but the lighting is often mixed and it may be impossible to obtain perfect colour balance. Fortunately, this rarely matters because the flashy, gaudy colours of the show make slight colour casts virtually unnoticeable. For the same reason, you can make the most of special effects which in other situations might seem excessive. A starburst filter, for instance, can add sparkle to sequined costumes. Remember though, that there is more to circuses than colour and sparkle alone—sometimes black and white shots can give more effective and atmospheric images.

The circus performance is full of glamour, colour and action, and there should be no shortage of pictures. So take along plenty of spare film—particularly if you use a motor drive to capture fast, unrepeated action such as trapeze jumps or stunt riding. A motor drive might also be useful for multiple exposure shots. By using the motor to fire the shutter in conjunction with the camera's multiple exposure control you might be able to show the stages in a trapeze leap or an acrobatic stunt.

Although fast action seems to call for fast shutter speeds, completely frozen action sometimes lacks the vital sense of movement. So it is worth interspersing the action-stopping shots with a few slow shutter speed, slightly blurred shots. To avoid the blur becoming excessive, wait for the turning point of any movement, when the artiste has stopped momentarily at the peak of the action—the trapeze artiste at the top of a swing, for instance, or the tumbler as he reaches the upright position on his hands. Other acts might also benefit from a slow shutter speed treatment. The slight blur of a juggler's balls ringing his concentrated expression could make an effective close-up.

Bear in mind that the most striking point in the action at the time might not necessarily be the most impressive in a still photograph. The moment the custard pie splurges over the clown's face might be the moment when the audience laughs, but a close-up showing the clown's mournful expression just a few seconds later as custard drips from his face might make a more effective photograph. Think in photographic terms, therefore, how the act might be best captured in a still photograph.

When shooting figures in the ring, it

Tiger *Here, the photographer pre-focused just in front of the hoop and waited for the tiger to jump through. Note the use of vertical framing.* **Audience** *Good candids can usually be found in the crowd*

Adam Woolfitt/Susan Griggs Agency

is usually worth fitting a telephoto lens and filling the frame. Individuals can otherwise look rather lost in the huge expanse of the ring. Close in on the facial expressions or moving hands as well as going for body shots—a pair of shots showing the knife leaving the thrower's hand and a close-up of the victim's worried face may show the tension far better than a wide shot.

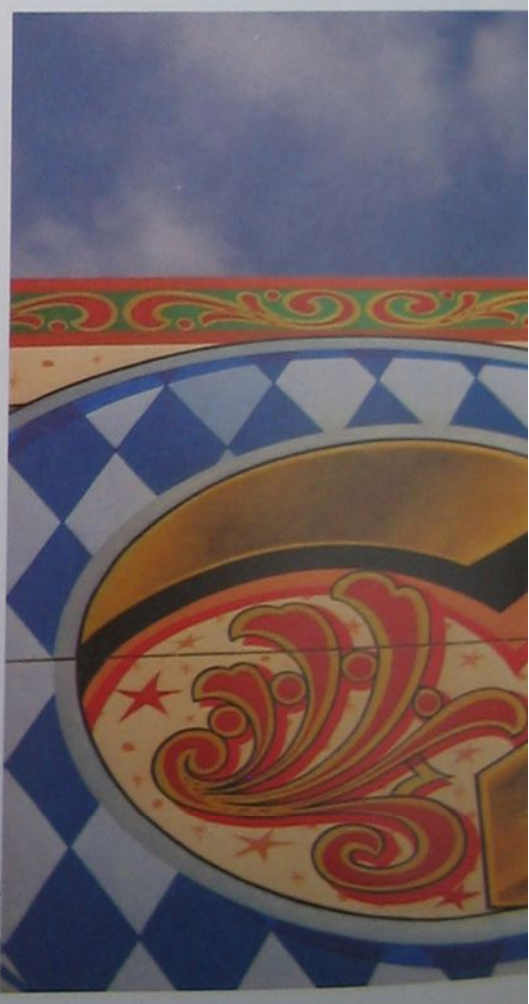
Animal acts can be photographed in many similar ways to other ring routines, although most of them take up more room, demanding a greater depth of field. Focus on the eyes of the star animal, or on the one which is showing the most expression. It is often worth including the trainer in the frame to give the shot extra impact. Many animal routines end up with a line abreast bowing to the audience in the expensive boxes opposite the ring doors. Be prepared for this, and try to include the complete row of animals and the front rows of the audience, as well.

Between shows you may be able to shoot some of the ceaseless activity behind the scenes—the performers making up, the animals being fed, the cleaning and painting of equipment and the general incongruities presented by half-costumed performers going about their everyday duties. You can select lenses and viewpoints to achieve unusual effects. For instance, you could exaggerate the massive height of a stiltman by shooting from ground level using a wide angle lens.

The carefully painted details on fairground equipment are usually worth a photographic study in themselves. Early in the morning, the soft light gives a true rendition of colour and little risk of reflections from glossy paintwork. With subjects which rely totally on colour for their impact, be careful not to go overboard by creating a profusion of colour. Pictures like this are often much more effective if only a few colours are included.

Fairgrounds during the daytime have the advantage of being fairly evenly lit, but probably the most exciting time for photography is in the late afternoon, when the sun is going down and the lights are just beginning to come on. A fine evening may give the photographer the opportunity to incorporate an atmospheric sky. The deep blue of a dusk sky can be an ideal background to the bright artificial lights—perhaps a circle of light trails caused by photographing a ferris wheel with a long exposure. At this time, providing that you select your viewpoint carefully, you may be able to shoot people in silhouette, either against the sky, or against the fairground lights themselves.

At night many of the booths can be so brightly lit that you can take portraits and candid shots without disturbing people with a flash. The light sources, however, are likely to be mixed, so you will not get accurate colours. But you will



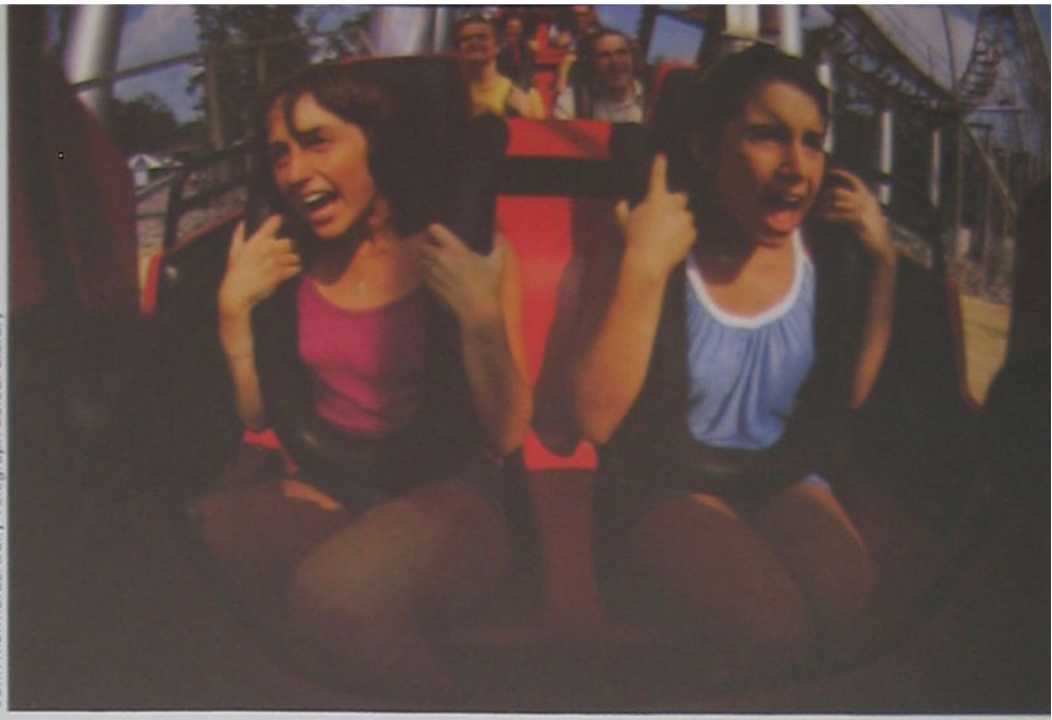
Ian McKinnell

retain the atmosphere given by the gaudy fairground lights which a flash would destroy. An 80B filter may be worth carrying with you to correct the warm colour of tungsten light. This may also strengthen any blue colour remaining in the evening sky.

Capturing the speed and excitement of the fairground rides can be done in different ways. If you want to capture an expression sharply it may be best to pre-focus on a certain spot. If a particular ride attracts you, try varying the shutter speeds to obtain different permutations of blurred and frozen images. Pick a face on the ride and pan with it, using a slow shutter speed. A sharp detail, particularly a human figure will add to the effect of the movement, whereas a frozen picture with no human interest may provide a record of the scene, but will lack any sensation of movement. You can use flash to stop the action on the rides, but try using the flash at a slower shutter speed than is usual to give an effect of a double exposure. You will achieve one image which will be sharp, and another which will be blurred from the available light.

Unusual pictures at a fairground are very often a result of an unusual viewpoint. Take the camera on to a waltzer, octopus or dodgem and view out from the centre of the action. You may gain a whole new perspective on the fairground below, and your picture will be more interesting if you include some people in the foreground to give a sense of scale, and also a sense of being up in the air. On the ferris wheel you have plenty of time to compose a picture from various positions while the machine is loading people.

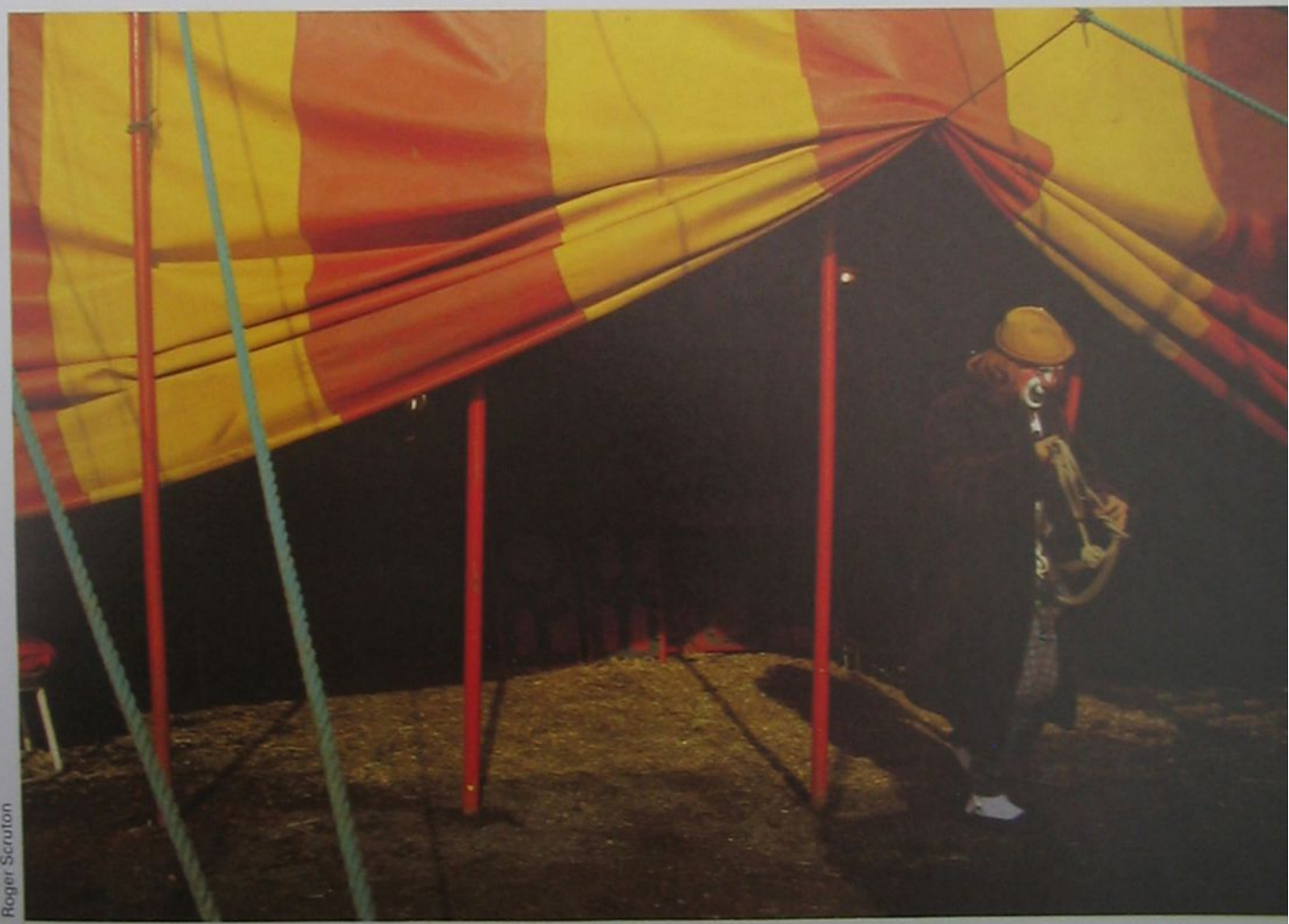
Do not forget to look out for humorous pictures at a fairground, and watch for people's expressions as they try their luck at the stalls. They will usually be too preoccupied to notice your camera. The delighted face of an excited child can sum up all the thrills of the day.



John Marmaras/Daily Telegraph Colour Library

Ferris wheel *The colour of the sky and the silhouette effect create this very atmospheric shot.* **Paintwork** *The shapes and colours of fairgrounds are ideal for abstract compositions.* **Rollercoaster** *For those with nerve, turning your camera on people behind you on rides like this can produce compelling images.* **Candid** *Careful framing and timing has resulted in the clown appearing against a mysterious, dark background. This dark area contrasts with the painted clown standing alone in the sunlight*

Adam Woolfitt/Susan Griggs Agency



Roger Scruton

Salvage work

Important photographs are frequently spoiled by careless exposure, processing or handling. Although some of these can be cured by simple printing techniques, salvage treatment is usually much better

If you have any negatives, prints or slides that are too dense, too light, too contrasty or even simply scratched, there is no need to throw them away in despair. You may be able to rescue them using a number of special treatments such as intensification and reduction.

Chemical intensification

Thin black and white negatives which have been underdeveloped may prove difficult to print even on hard paper. An improvement can sometimes be made by strengthening or *intensifying* the image (see pages 1722 to 1723). Commercially prepared intensifiers are available, but you can easily make up your own *chromium intensifier* by using the formula provided (see panel). This is a *proportional* intensifier which increases all densities on the negative in proportion to the original density. Dark parts of the image—the highlights of the original scene—are intensified more than the lighter shadow areas, so image contrast is increased. The image is intensified by the addition of small particles of a compound of, in this case, chromium to the existing image. A negative treated with chromium intensifier will make quite reasonable prints, although these will never be as good as those from a properly exposed and developed negative. The image is also much more grainy.

Clearing highlights
A weak reducer bath can be used for clearing slightly overprinted highlights. Here, combined with judicious dodging, it adds more depth to the picture than is obtained in a straight print (inset)

Tapdance

The process involves first bleaching the image in a bath consisting of an acid dichromate, then redeveloping the film in any film developer which contains little or no sodium sulphite. Thus MQ and PQ developers could be used, whereas fine grain formulae containing large proportions of sulphite are unsuitable—ordinary print developer is ideal.

Before starting work on your negative, clean all dust and fingerprint grease off the film using a proprietary antistatic film cleaner or cloth. Give the film a presoak in a bath of tepid water to which a few drops of wetting agent have been added. Chemical intensification or reduction tends to soften gelatin, so unless you use an acid fixing and hardening bath in normal processing, an additional presoak in an alkaline formaldehyde prehardener bath should follow (see panel).

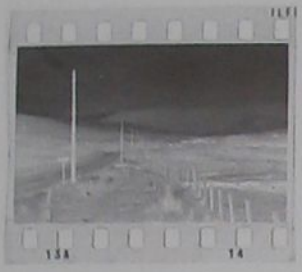
After washing, place the film in the bleach solution until bleaching is complete—the image should then look brown. Wash briefly and place in a five per cent sodium metabisulphite solution, to remove all yellow stain. Follow this with a brief wash in water and a final rinse in a five per cent borax solution. Afterwards, using a suitable developer, develop the film in bright light until the image has redarkened completely. Wash the negative, and hang it up to dry.

Making a copy negative

As intensification tends to lower the keeping qualities of negatives, as well as causing a noticeable increase in

Intensification

Underdevelopment was mainly responsible for this weak original image which, even when printed on the hardest grade, remains flat



Chrome intensifier treatment—a bleach bath followed by complete redevelopment —gives a punchier image

John Ward

graininess, you may prefer not to attempt work on a valuable original negative. Instead, make a duplicate, either by copying with your camera or, perhaps more easily, by using your enlarger. In this way a duplicate negative can be made by contact printing an intermediate positive enlarged from the original negative. Blue-sensitive or orthochromatic film may be used for this purpose. For extreme cases a thin negative could be printed on a high contrast material, such as lith film, which is then developed in a soft working developer based on metol. This positive could then be made to print the working negative.

In fact, the process of copying can lead to a significant increase in density and contrast and you may find that sufficient *optical intensification* occurs in this way and makes further chemical treatment unnecessary.

Toning methods

Another simple way of increasing the effective density of a black and white negative image is to use a sulphide toning bath—but try this only on a very flat negative as the contrast jump can be appreciable when it comes to printing the result. You can use the formula provided on page 711 for this.

If you have a dye coupling or dye mordant toning kit, you could try toning weak black and white negatives using these (see pages 1734 to 1737). The resulting coloured images will only print if they are blue-based on ordinary printing paper, but offer exciting possibilities if printed—along with selective filtration changes—on Kodak Panalure paper which has panchromatic sensitivity (see pages 1070 to 1073).

Dealing with dense negatives

Dense negatives can be caused by overexposure or overdevelopment. To make printing easier, one of several types of reducer can be used. A subtractive reducer will reduce all silver deposits equally, so contrast is largely unaffected. The most commonly used is Farmer's reducer (for formula see page 767).

Normally this is used in the proportion one part A to five parts B but it is usually more convenient to add a very small quantity of Solution A to Solution B—enough to colour it pale yellow. The more of Solution A that is added to Solution B the more vigorous the action of reduction. To play safe, snip off a scrap frame to test the rate of reduction at any particular dilution. At strong concentrations the working life may be no more than 10–15 minutes. Immerse the negative film in the mixture. Remove it just before the required degree of reduction has taken place. Wash the film thoroughly afterwards.

Another subtractive reducer uses potassium permanganate and sulphuric acid—ingredients which can also be used for a proportional reducer (see below). To use the standard permangan-

Formulae

Alkaline formaldehyde hardener

Water	750 ml
Formalin (40 percent)	20 ml
Sodium carbonate	10 g
Sodium sulphate	100 g
Water, to make	1000 ml

Immerse film in the solution for at least five minutes before continuing with aftertreatment such as reduction or intensification

Chromium Intensifier Dichromate stock solution

Water	300 ml
Potassium dichromate	50 g
Water to make	500 ml

This solution keeps indefinitely

Bleaching solution

Stock solution	100 ml
Hydrochloric acid conc.	2.5 ml
Water to make	1 litre

For use mix two parts Solution A and one part Solution B with two parts water. For slight intensification use equal amounts of A and B; and for strong intensification increase the proportion of Solution A.

Potassium permanganate reducer

Solution A

Potassium permanganate	25 g
Water to make	500 ml

Solution B

Water	475 ml
Sulphuric acid	25 ml

NEVER add water to acid.

Solution C—clearing bath

Sodium metabisulphite	20 to 50 g
Water, to make	1000 ml

For use, mix one millilitre each of solutions A and B with 250 ml water. Immerse the film until the image is sufficiently reduced. Clear the purple brown stain by placing the film in Solution C.

Permanganate—persulphate reducer

Solution A

Water	750 ml
Sulphuric acid conc.	1.5 ml
Potassium permanganate	0.25 g
Water to make	1 litre

NEVER add water to acid

Solution B

Water	750 ml
Ammonium persulphate	25 g
Water to make	1 litre

For use, mix one part Solution A with three parts B. Follow bleaching with a metabisulphite bath.

Iodine Bleach

Water	750 ml
Potassium Iodide	15 g
Iodine	5 g
Water to make	1 litre

This solution is used full strength.

ate reducer, mix one part each of solution A and B (see panel) to 250 parts water and immerse the negative until the image has been sufficiently reduced. Wash briefly and dip the film in five per cent potassium metabisulphite solution to remove the purple/brown stain and follow this with a good wash.

Negatives that have been underexposed and overdeveloped tend to be contrasty. If this cannot be corrected by printing on a soft paper, it is possible to use a proportional reducer to lower the contrast. This removes the silver image in proportion to the density already there —dense areas are more greatly affected than light areas.

Very dilute Farmer's reducer acts proportionally but a more reliable formula in this application is permanganate–persulphate reducer (see panel). Mix one part of A to three parts of B. Clean and presoak your negative then transfer it to this solution. When bleaching is complete, immerse the negative in metabisulphite solution to clear the film. Wash the negative thoroughly and hang up to dry.

Correcting prints

If a print is too soft or too contrasty, it is usually quicker and simpler to change the grade of paper and reprint rather than to go to the trouble of bleaching, as intensification rarely increases density successfully. However, with prints that are lacking in contrast, reducing can have a dramatic effect. Reducing or bleaching the whole print increases contrast as the highlights and lighter tones are affected first.

Farmer's reducer is used and the print is simply immersed in a dilute solution of this until a satisfactory reduction has been made. It is not possible to remove dark tones with this solution: it will only leave a brown stain where the silver image was previously. Selected areas that are not too dark in tone can be lightened by painting the Farmer's reducer on to a damp print, using a fine brush or cotton wool swabs.

After reducing the print, wash it thoroughly in running water to remove traces of bleach and refix. Then wash and dry the print as usual.

If for some reason very dark tones need completely removing from a print, use iodine bleach. It is possible to bleach the silver image away completely using this solution—but it will stain the print during the process, but the stain disappears when the print is refixed and washed thoroughly.

Marked film

Always dust down negatives before use and before putting them back into the negative sleeve for refiling. If you suspect that the sleeve is dusty or soiled, discard it and use a new one. While printing, place negatives emulsion upwards on a clean dry surface in between use and storage. But despite precautions like this negatives can become grubby and damaged through repeated use.

Reduction

This extremely dense image requires very long and inconvenient printing exposures, and gives an image which is too contrasty

By immersing a really dense negative in a suitable reducer, a much more easily printed negative is obtained

Robin Scagell

Stubborn marks, though not scratches, can sometimes be removed by giving negatives a long soak in tepid water to which wetting agent has been added. Then gently rub the film with the ball of the thumb—be careful not to grind surface grit into the soft emulsion. Afterwards hang up the film to dry in a dust free place.

If you have an enlarger which uses diffuse illumination, minor surface scratches on a negative probably will not show when printed. Even superficial scratches become much more noticeable if a condenser enlarger is used. With tiny scratches, it is probably best to rely on print retouching rather than attempt any corrective treatment. But print retouching is tedious, particularly when a large number of prints are needed from your scratched negative. Although there is nothing you can do for deep scratches which actually remove emulsion right down to the clear film base, surface scratches can be minimized by using a proprietary scratch treatment such as Tetenal Repolisan. Repolisan consists of a clear liquid which has similar refractive properties to emulsion gelatin. This fills surface scratches and so lessens the light-scatter effect which makes scratches so visible, particularly with condenser illumination.

As Repolisan is inflammable, work in a well ventilated but dust-free room, away from naked flames. Wear gloves to avoid any contact with the skin. Do not attempt to treat a full film length at once, as it is difficult to handle and dry and may cause streaking. Cut the film into short lengths as you would for storing in negative files—or even into individual frames. First carry out a test run on a spare or discarded strip of film to practise the procedure.

Careful treatment *It is best to try out reduction or intensification on a similar (but dispensable) negative to the one you eventually wish to treat*

Dave King

Start by cleaning the film so that it is dust and grease free. You can use proprietary antistatic film cleaner for this. Soak a piece of lint free cloth in the antistatic solution and pull the film

Condenser scratch *This print shows what a scratch on the film base looks like when a condenser enlarger is used*

Diffuser scratch *The same scratch looks much less noticeable when the negative is printed in a diffuser enlarger*

John Ward

Scratch treatment *Using a glycerine, glass and negative sandwich completely eliminates the scratch*

gently between the cloth held in the hand. When the film is thoroughly dry it is ready for treatment.

Pour the Repolisan into a dry clean saucer or Petri dish. Pour carefully to make quite sure that no air bubbles form in the solution—never shake the bottle. Pass the film backwards and forwards through the Repolisan making sure that both sides of the film are coated—but do not let the film soak. Hang the film up to dry in a cool, dust-free place. The process may be repeated once if the first application is not enough to remove signs of scratches.

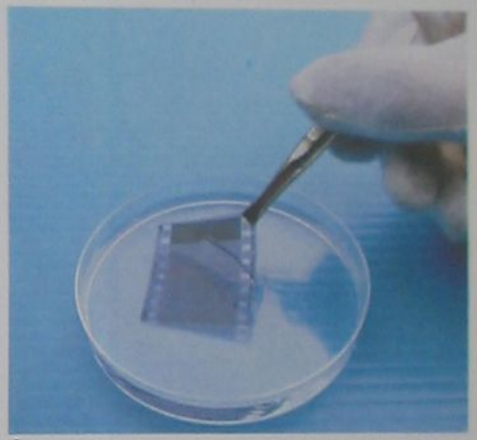
If for any reason the Repolisan has to be removed from the film, soak it for one minute in Repolisan solvent to soften the coating and then rub it off with a lint free cloth soaked in the solvent.

Clean all the equipment you use by thoroughly washing in an acid solution (such as stop bath) and finally in running water. Do not pour unused Repolisan down the sink as it may damage the drains.

Although Repolisan treatment is fine for long-term treatment of negatives which you may want to print time and time again, there is a real risk of getting dust trapped in the coating unless you take careful precautions to eliminate airborne dust during the drying period. This may mean that you have to make several attempts before you obtain a suitably 'clean' negative.

A more convenient, though slightly messier, method is to treat the negative with glycerine immediately before printing. This treatment is only temporary but simple and effective. Sandwich the negative, along with a few drops of glycerine, between two sheets of thin, well cleaned glass. You can use slide mounting glass for this if you are careful—or the glass of a negative carrier. Simply place the sandwich where the negative would be when printing normally. After use, carefully prise the sandwich apart to remove the negative and rinse this in water to remove the glycerine. Hang up the negative to dry, and then clean the glasses.

1



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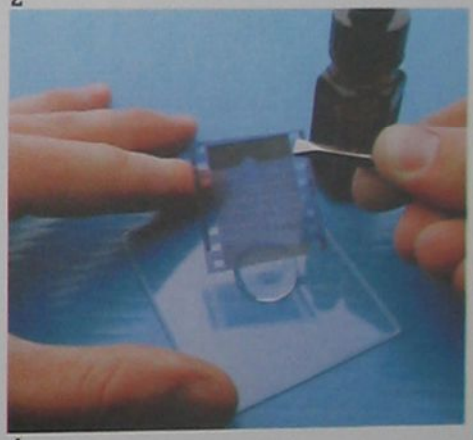

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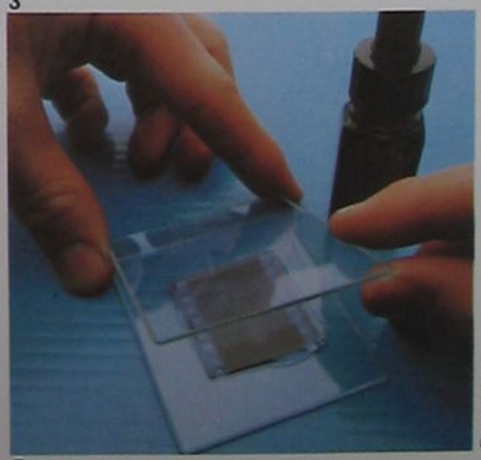


5

Dave King

Scratch treatment

Using glycerine is a cheap, simple and very effective way of eliminating light scratches. Start by cleaning the negative to remove dust first and then any surface marks (1). It is best to work on individual frames (2) if these are to be coated with a scratch treatment, such as Repolisan. If you use glycerine, place a few drops on one of a pair of dust free and clean glass negative carriers, being careful to avoid air bubbles (3). Add more glycerine and then simply complete the sandwich of the negative (4) and cover glass (5), again avoiding bubbles

Understanding...

Colour response-2

Many of the deficiencies in the colour response of modern films can be traced to the dyes used to sensitize the emulsion to blue, green and red, and to make the image visible. But just why are these dyes used?

In the early days of colour photography, scientists experimented with direct, objective colour processes and several systems were marketed around the turn of the century. Unfortunately, although potentially superior in theory, these systems proved impractical, requiring elaborate viewing arrangements or impossibly long exposures. The way forward seemed to lie with the three colour principle demonstrated by Clerk Maxwell in 1861 (see page 1914). But this system brought many problems of its own.

Although by sheer coincidence Maxwell's experiment worked, the three colour system really needs emulsions sensitive to each of the three colours. Yet the early photographic emulsions were sensitive to blue light only. So three-colour photography had to await the discovery by Dr. H. W. Vogel in the 1880s, of dyes that could be added to the emulsion to sensitize it to colours other than blue.

After this discovery, three colour photography began to progress in leaps and bounds, but the sensitivity range of silver salts remains even now a barrier to achieving perfect colour. Just as the blue sensitivity of the silver salts cannot be removed altogether to give a pure red or green response, it is difficult to ensure that the dye added to sensitize the emulsion to green does not also sensitize it a little to red as well (and vice versa). And the ideal of a perfect match to the three sensitivities of the human eye is all but impossible to achieve.

It is important to remember that these sensitizing dyes are totally different from the dyes that form the image in a modern colour slide or negative. They are simply there to make the emulsion responsive to red and green light: without these dye sensitizers three colour photography would be impossible. The image dyes, on the other hand, play no part whatsoever in the formation of the latent colour image. Indeed, the early colour processes that followed Vogel's discovery of dye sensitizers did not use image dyes at all.

These early processes were all, like Maxwell's experiment, based upon *additive synthesis* of colour: modern colour films are essentially *subtractive*.

courtesy of the Kodak Museum

Flying colours *This picture, dating from 1939, was taken on Kodachrome, the first ever subtractive tripack colour film*

To understand the difference between additive and subtractive processes, it is important to appreciate just why blue, green and red are considered by scientists to be the primary colours—particularly since artists know the primary colours as red, blue and *yellow*. This is essentially because of the difference between colours in a beam of light and the pigment colours reflected from paints, dyes and every natural object.

Light and pigments

In a beam of light, all the colours of the spectrum can be created by *adding* together various proportions of blue, green and red (the *additive primaries*). The colour of a pigment is simply the colour that remains after various proportions of blue, green and red have been absorbed or subtracted.

Just as light of any colour can be created by adding blue, green and red, so a pigment can give any colour by subtracting these colours from white light. The colour seen by the eye once one of the three additive primary colours has been removed is a complementary colour or a *subtractive primary*. The colours left after the subtraction of blue, green or red are, respectively, yellow, magenta and cyan. Yellow, for instance, is a pigment that reflects a mixture of red and green—that is white light with the blue taken out.

The artist's primary colours are, in fact, the subtractive primaries—the red is really magenta and the blue is really cyan. A pigment that is seen as true red has absorbed both blue and green light so it involves two subtractive primaries—a yellow to absorb the blue and a magenta to absorb the green.

Photographically, the significance of this is that you can add blue, green and red *light* to achieve any colour, but you cannot add blue, green and red *pigments*. A subtractive primary pigment subtracts one third of the spectrum; an additive primary pigment is a combination of two subtractive primaries and so subtracts two thirds.

Additive processes

For 50 years after Maxwell's experiment was carried out, photographers relied on systems using only the additive primaries. To record the image for an additive process, a separate black and white negative is made for each of the three colours by making an exposure through filters of each colour. For the full colour image, each of these negatives must be projected in perfect register through appropriate coloured filters.

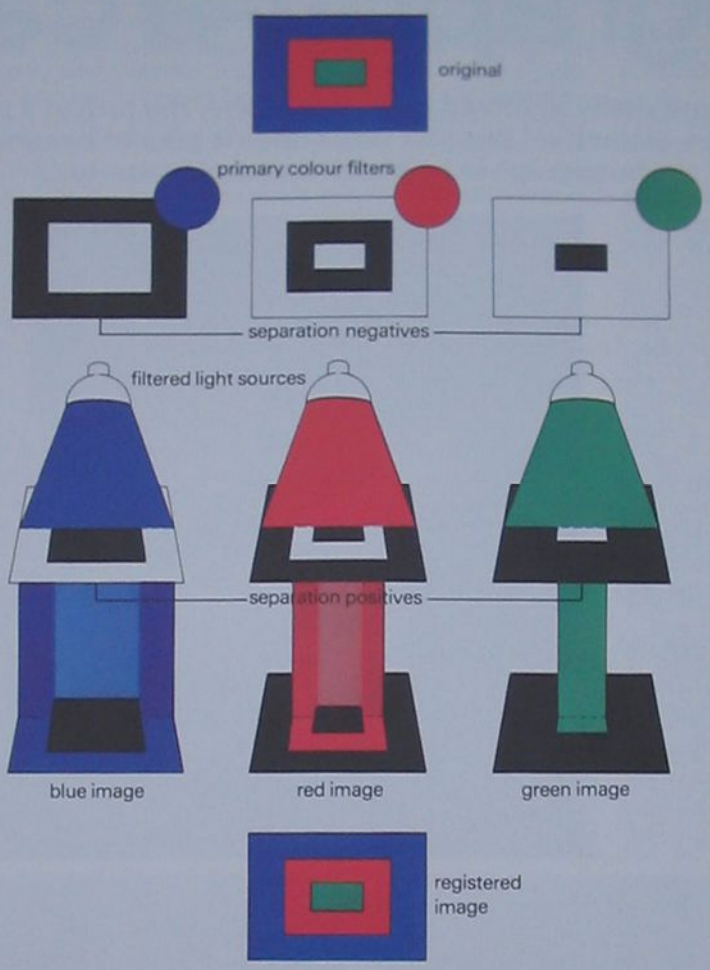
Initially, the additive process seemed much simpler since only the projection and taking filters need to be coloured; the three images can be recorded and ren-

dered in black and white. But it is impossible to combine all the negatives and filters into a single pack as the filters will simply combine to block out all light. So the negatives and their appropriate filters can only be combined as projected light—three separate images are always needed.

Photographic scientists attempted to overcome the problems and produce a single additive colour negative by using screens containing thousands of minute filters in each of the primary colours. The image would then be seen as densities of dots or lines of the appropriate colour—just like modern colour television. In one early additive colour system, the Lumiere plate of 1907, these filters were tiny grains of dyed potato starch stuck randomly to glass. A later process, Dufaycolor film (1930), used a regular *reseau* screen—resistant greasy ink lines drawn over the emulsion.

Unfortunately, these additive screen processes suffered from tremendous light loss. Yet using separation negatives was clearly impractical for everyday photography—though of course they are ideal for printing. So additive colour eventually give way to subtractive colour.

Additive colour



Additive colour processes use only the additive primary colours—blue, red and green. Like the subtractive process, the image is recorded in three monochrome negatives, but the colour is restored for viewing, not with coloured dyes, but by light filtered to give the appropriate colour. The main stages are (1) Separate exposures through filters to give three black and white 'separation' negatives (2) Making of three positive slides from the negatives (3) Projection of slides in register with blue, red and green light

Subtractive colour

Subtractive colour is based upon complementary colour dye filters—yellow, magenta and cyan—which subtract just one primary colour from light passing through. The three colour emulsions, sensitive to blue, green and red can be placed directly on top of each other as a tripack to record the image. In processing, a complementary coloured dye is formed in each emulsion layer. This can then be either used as a negative or reversed to make a slide (see pages 550 and 578). Each colour is given by the way each of the three complementary colour dye images filter the light passing through the film. In a slide, when see a pure red, we are actually seeing white light through a yellow layer and a magenta layer—that is, white light with the blue and green component removed.

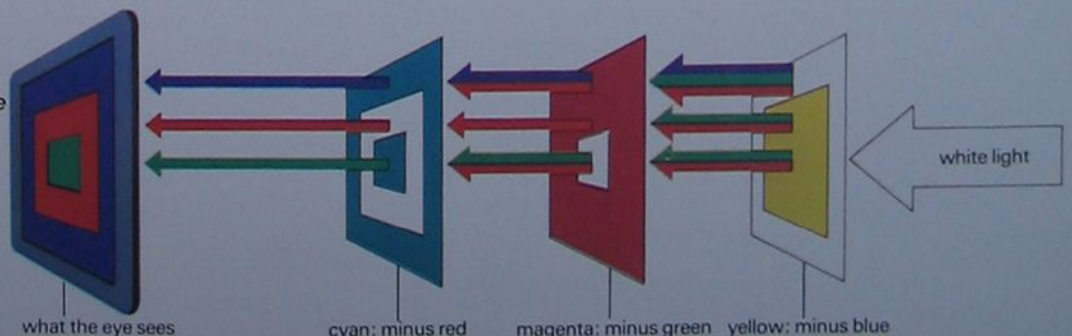
This system depends upon the formation of appropriate colour dyes in each layer and it was the difficulty of achieving this that delayed its success until the mid 1930s. Various methods were tried but only two proved their worth for films: the colour coupler system and the Kodachrome system.

The colour coupler system, first suggested by Rudolph Fischer in 1912, involved the inclusion of substances (the colour couplers) in the emulsion that would stimulate the formation of appropriate coloured dyes in each layer during processing. Because these colour couplers are included in the emulsion, this system is referred to as an *integral* tripack. Unfortunately, the couplers tended to wander from layer to layer during processing, stimulating the formation of the wrong dyes. It was not until 1936 that Agfa managed to solve this problem by making the couplers out of extremely large molecules. A later solution, first marketed by Kodak in 1946 as Ektachrome, dissolved the couplers in minute oily globules to hold them in the appropriate emulsion layers.

Meanwhile, in 1935, Kodak had introduced the first subtractive tripack film using an entirely different system. With Kodachrome, the dyes are added to each layer in a separate process and integral colour couplers are unnecessary. Both Kodachrome and the integral tripack, now firmly established, made colour photography a practical and attractive proposition for the amateur and gave it a versatility it could not possibly have had previously. But slight deficiencies in colour response remain.

Subtractive colour: how we see colour slides

Subtractive systems can use a tripack of blue, green and red sensitive emulsions in one negative because the colour image is three layers of dyes in complementary colours. Each dye layer subtracts one primary from white light and we see what is left. We see blue, for instance, where magenta and cyan dyes have removed green and red



Alan Suttie

Photography—a career?

If you become really involved in photography, the lure of a professional career may prove attractive. But just what does it take to become a professional photographer and how do you get started?

Many people are attracted to what they imagine is the utterly stylish life of a photographer. They seem to have the idea that it involves non-stop glamour between the occasional focusing of a lens and a terse instruction to a model. Some photographers certainly do lead the most amazing existence, but they make up only a tiny fraction of those working within the profession. As in most things, the majority have a far more down to earth time, in this case working as 'general practice' photographers, meeting the ever-present demand for school portraits, wedding pictures and product shots.

Broadly speaking, photographers can be divided up into those who work on their own, and those who work from a studio, or as part of a team. The nature of the work involved tends to define the general working situation. Advertising, commercial and industrial photography tend to require rather more in the way of complicated equipment and 'props' and so are often done in a studio, in co-operation with designers, set builders and make-up artists, for example. On the other hand, press, editorial and art photographers tend to work alone—often so they can be unobtrusive and go about their work with the least disturbance possible to whatever it is they happen to be recording, so this kind of photography can be very isolating.

Unlike a more rigidly defined profession such as the law, the ways of entering photography seem to vary almost as much as do the types of photographs taken. However, there do tend to be three basic ways of 'getting started'. People can go to a school or college for formal education; they can become an assistant to an established photographer; or they can make a lucky break from being a gifted amateur. Photography can also be an area that many people take up as a second or third career later on in life, as a development of some related work, or as a radical change from something different.

One of the first things any prospective photographer must be clear about before taking any action is just what area of photography he or she is interested in. Upon this inclination will depend the best choice of entry and subsequent experience and training. Probably the simplest, and the best way of finding out what the various areas entail is by visiting photographers and talking about the exact nature of the work they do. The yellow pages of the telephone directory are an immediately accessible source of information as many photographers and studios are listed there. Do not be afraid to approach people directly, but always phone first to make an appointment. Photographers are usually busy people but more often than not are prepared to share experience and advice.

At the same time as exploring the various fields of photography it is a useful exercise to try and assess your own strong points. Most professionals agree that success depends upon many talents, most of which have little to do with visual, aesthetic or technical skill.

Dave King

Learning on the job *Many young photographers start by working as an assistant to an established professional*

Wedding photography *Although often demanding, there may be many opportunities for working locally*

Wedding and society photographer Tom Hustler joined the army when he left school and then became a stockbroker trainee. Neither of these suited him. Feeling that the only thing he was 'remotely good at was snapping people with a camera', he followed Lord Snowdon's advice not to go to a college. Instead, he joined a photographer who was in the field that he wanted to pursue—Royal portrait photographer Dorothy Wilding—in 1967, actually buying her business a year later. He specializes in portraits, weddings and general 'society' events in the United Kingdom.

Today's professional photographer needs to be part diplomat, publicist, adventurer, technician, salesman and accountant. His or her assets must include a flair for organization, reliability, competitiveness, self-discipline, integrity and —most importantly—an ability to handle people. Throughout their working lives photographers must inspire confidence in the people they are working with and for (even if they don't happen to feel it themselves).

As well as the telephone book there are several other published sources which provide basic information. The numerous photographic magazines list courses and there are several directories which should be available through a local library. In Britain, two ready sources of information stand out. One is *The Creative Handbook*, which lists all relevant professional organizations, who will often provide detailed information and contacts, and numerous other useful names and addresses. The other is *Where to study* published by the British Journal of Photography which currently lists over 600 courses in Britain.

Generally speaking, photographic courses are at three levels: diploma and certificate courses: undergraduate degree courses and postgraduate courses. They vary in length from months to three years. The academic qualifications required vary tremendously, but an ideal background would combine both science and arts subjects. Most diploma courses in Britain require a minimum of three 'O' Levels often with a specification that English, art, or mathematics is included. Many undergraduate courses give preference to students who have completed a 'foundation year'. This is a year's general art training at an art school or polytechnic, usually the institution nearest to a student's home.

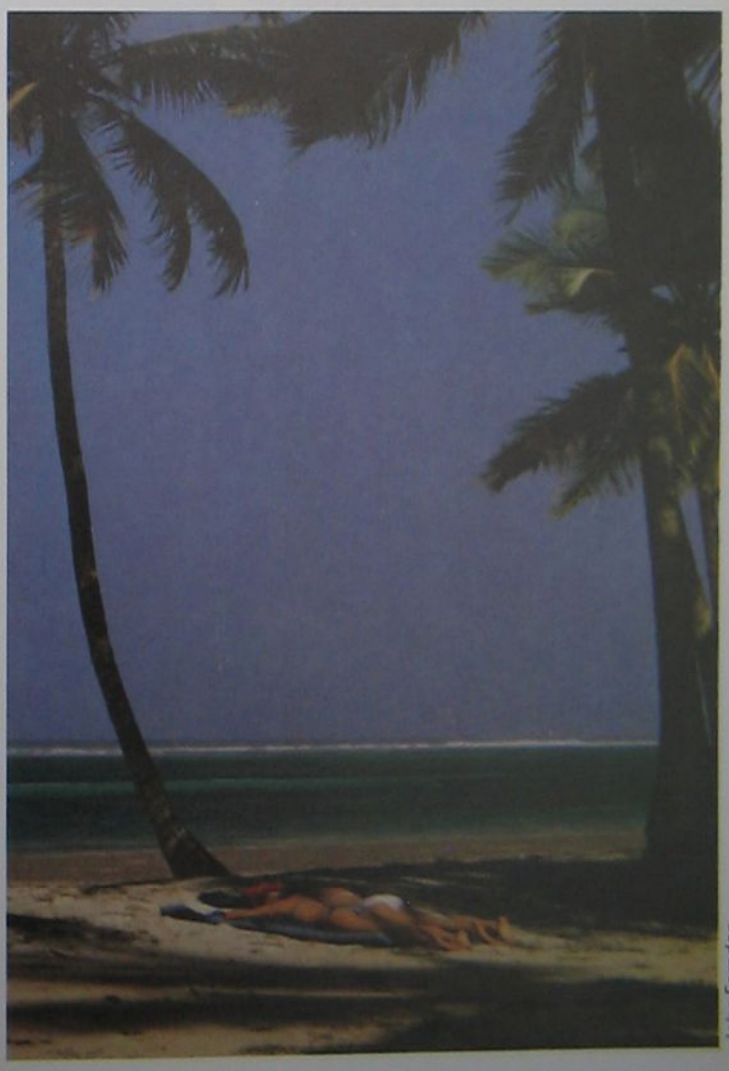
Most prospective students are interviewed by a selection panel, where not only work but general personality and aptitudes are assessed, including the applicant's ability to 'communicate'—often both visually and in the written word. As the finances available for education decrease and places become more limited, entrance requirements are often becoming correspondingly more demanding. The colleges are simply able to be more choosy.

Having discussed possibilities with people within the profession and then looked at the various courses offered, it is a good idea for prospective students to visit the college they want to study at, again making an appointment beforehand—you do not want to arrive on a day when everyone is busy doing something else. Talk to the lecturers, and most importantly, to the students, to get an idea of the various aspects of the particular course. Try to examine the facilities and see if the kinds of equipment you think you will be interested in are available (and likely to be in good working order). Some courses have a strong technical bias, while others are more concerned with aesthetics and communications theory. It is up to you to find out what particular blend is on offer and whether it suits your requirements.

At a slightly less formal level than polytechnics and colleges, some professions and large bodies organize their own special training. Large industrial firms often take on trainees, and either train them, or allow them time off to attend day release or block courses elsewhere. Provincial newspapers in Britain take about 50 photographic recruits each year, the majority of whom apply directly at local level. For this, five 'O' levels including English language are required, but some exceptions are allowed for previous photographic experience or further education. Trainees attend two eight-week courses and work on their employer's paper in between.

The Royal Air Force also offer photographic training and many civilian aerial photographers received their early experience in this way.

Tom Hustler



John Farndon

On the beach *Many professionals and talented amateurs market pictures taken while travelling abroad to picture libraries and agencies*

Some people are offered the opportunity to start training as a darkroom assistant. Be careful if you really want to work outside as a photographer rather than as a printer—it can be difficult to make the transition later.

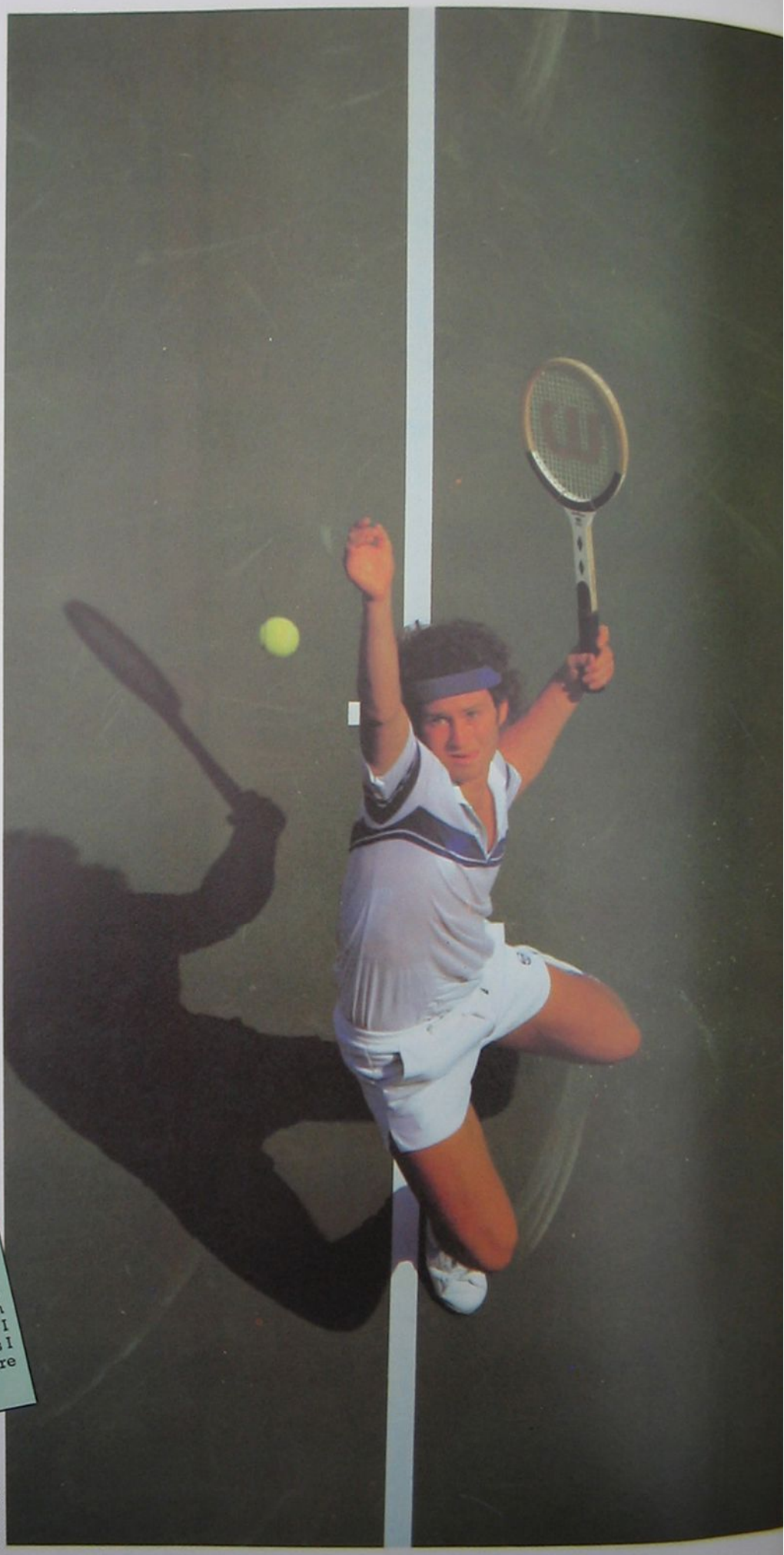
Formal education is often only the beginning of the photographic training process. Recent graduates are rarely able to set up in business on their own account, but they do have the advantage of having gained a thorough background in the broad areas they have chosen.

The next step for many people is to work as an assistant to a photographer, for a period of two to seven years. In the same way that it is essential to choose the course that most closely meets your individual requirements, so too should the would-be assistant carefully choose a prospective employer. It is virtually a waste of time, if you want eventually to be an advertising photographer, to spend time as an assistant to a wedding photographer.

The most obvious way to go about getting an assistant's job is to write to all the photographers whose work you admire, asking them if they need an assistant—being prepared for as many rejections or non-acknowledgements as people you approach. But keep trying, and make sure you are seeing the right people. Other photographers may be prepared to advise you who is working in the area you have chosen.

Professional bodies are prepared to help, as they often keep a register of members who require assistants. In Britain, the Association of Fashion, Advertising and Editorial Photographers (AFAEP) actually hold regular sessions for job hunters. They provide information and keep a book of work available with their members. The Institute of Incorporated Photographers and the Institute of Medical and Biological Illustration are similarly able to provide helpful information in the UK. It is also useful to read the trade press and magazines published by the various professional bodies as job opportunities are sometimes listed in these.

Sports specialist Leo Mason was working as an art director of an advertising agency when he went along with a photographer he had commissioned to take pictures at the Munich Olympics for a paper company brochure. He took some pictures as well—the first time he had seriously done so. A mixture of shots from both were eventually used. From here, his interest grew and he started working full time in photography in 1975, specializing in sport. He says he strives to show a new viewpoint of sport. 'I try to interpret what I see rather than simply recording what I see. This means I seldom shoot at the peak of the action as I am looking for a more definitive picture of what is going on.'



Sports photography *has become highly competitive and demands both subject knowledge and good technique*

Leo Mason

When writing to would-be employers, it is important to list as many relevant skills and personal attributes as you can. Any past working experience involving organizational or research skills should be mentioned. It is important also to detail all the types of equipment you are familiar with, though assistants are not usually expected to have their own equipment. Useful attributes include a good telephone manner: a foreign language: driving licence: passport and current inoculations: wide general knowledge of everything from the whereabouts of junk shops for obtaining props to suppliers of dry ice: ironing and coffee-making skills: typing: and, lastly, a thick skin!

As a photographer's assistant you will need more than technical or artistic flair—you must be mentally prepared for many negative aspects of the job. Rates of pay are often low, assistants may well be expected to work antisocial hours without overtime pay, and many feel exploited—particularly as they know that the photographer's day rate may well be several times the national average weekly salary! And you will soon find that you are unlikely to be taking photographs yourself at first. There are too many other menial tasks to be done.

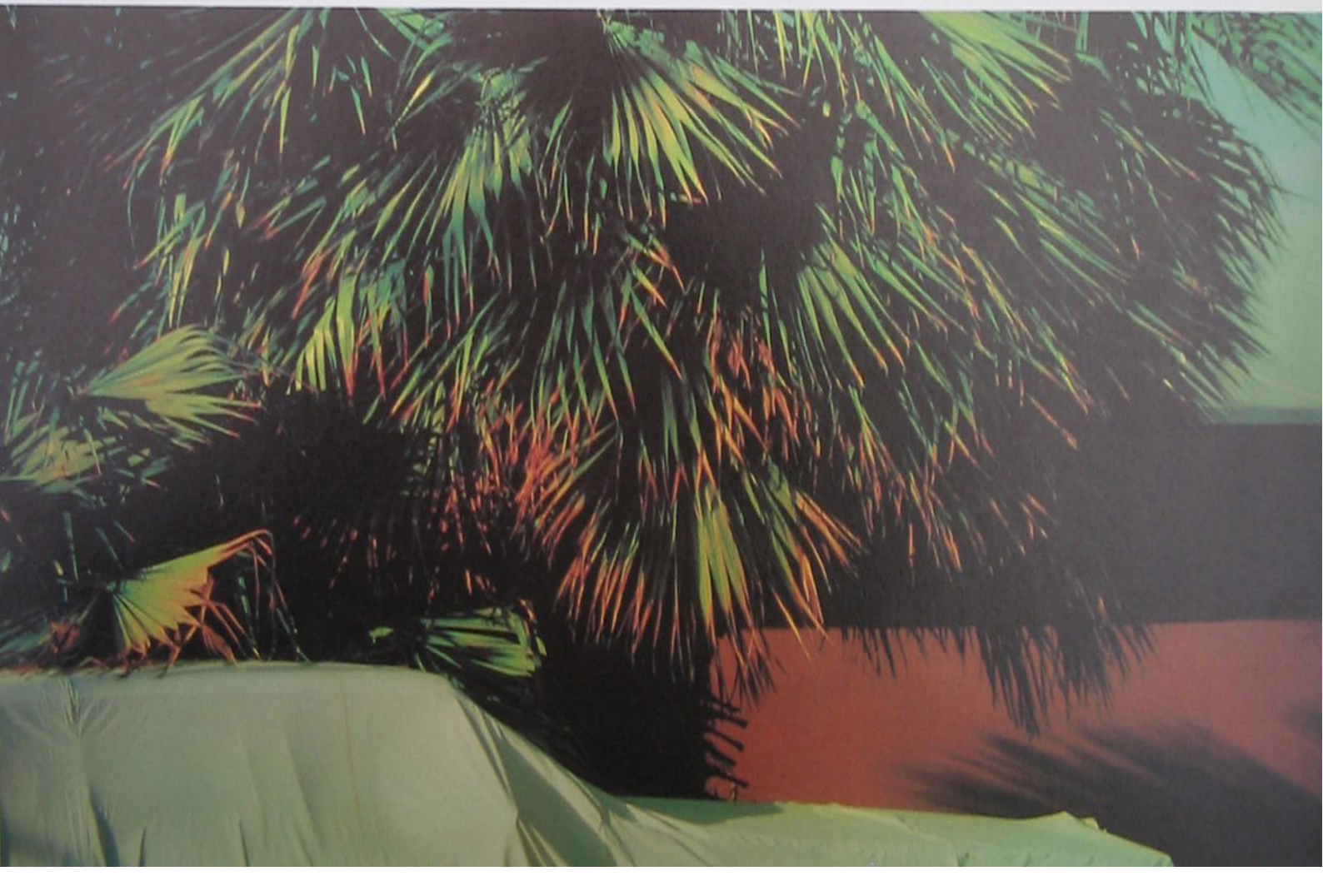
But obviously, there must be compensations. Generally, the life of an assistant includes some fun combined with undoubted hard work. All the time the assistant is learning about the area of work the employer has specialized in,

Akira

The latest look *Fashion photography calls for bright ideas, and confidence and skill with models*

Calendar shots *The market for calendar work is wide open, and talented amateurs can often do well*

Fashion photographer Akira Kobayashi is now based in London, but originally trained as a designer in Japan. He first worked as a designer in small advertising agencies. He then worked as an assistant to another photographer before going to California where he did odd jobs to survive, but took pictures for himself in his own time. He then went back to Japan and set up his own small studio. He had friends in London, so was able to get work through them when he first arrived in Britain. He says he enjoys the fact that he is in a new country and so must take an entirely fresh approach to his work, but it is still hard work doing the rounds of fashion editors, trying to interest them in his work.



Press work *Exotic assignments, such as covering a Royal Tour, are only achieved by established photographers*

Malcolm Clarke

Fleet Street press photographer Malcolm Clarke, who now works for the major national daily newspapers in Britain, went to agricultural college when he left school, intending to have a career in farming. However, while there he met a local press photographer, and ended up spending more time on photography than he did on his studies. He then tried to work for a local newspaper and was finally taken on by a local studio for £14 a week, which even in 1973 was not very much. He got the job by writing to all the studios in his area from the list in the Yellow Pages. He moved to another studio, then to a local newspaper, then to another one, then to a picture agency. In 1978 he was offered the opportunity to start a photographic unit for an English language newspaper in Dubai, covering the whole of the Middle East. He returned home in 1980 and now works freelance.

and many people allow their assistants to use their equipment or studio during quiet spells. This is invaluable for gaining 'hands on' experience with the equipment. Another important feature of being an assistant is that it often means you get to know the photographer's contacts—such as art buyers, stylists and so on—which is especially important in fashion and advertising. It is also an opportunity to pick up all the little 'con tricks' of the trade—when to use perspex ice cubes and which particular filters flatter subjects.

Perhaps most importantly, an assistant learns about handling people, from models to art directors to local council officials, gaining confidence all the while. General organizational skills should also be acquired, such as the way to assemble all the materials required for a job and how to price jobs and general business practices. Once an employer has confidence in an assistant, he or she will often pass over small assignments, giving the assistant complete responsibility. Assistants are often left very much to their own devices—it is up to them to use initiative to learn about the photographer's equipment in their own time.

After some considerable time as an assistant, therefore, you will begin to feel confident that you can handle a range of jobs on your own, and may well try to branch out on your own. Your employer may agree to your setting up as an independent photographer using the same studio—many people work in this way to make the best use of expensive facilities. Alternatively you may have to go it alone. But it is dangerous to make the break too soon—if you do a poor job early in your career, word will get around and you may not get another chance to prove yourself.

When starting out as an independent, it is important that people should be able to contact you easily. It is recommended that photographers should have a business card—preferably with a striking example of their work on it. This can be expensive, but is a useful way of reminding others about the particular kind of work you do. The address and telephone number should stand out clearly, and it must be easy to make contact—a telephone number with no one to answer it is useless. Many photographers now rely heavily on answering machines and air call services so they are contactable at all times. And when writing to people and organizations, send stamped, self-addressed envelopes.

When it comes to selling work, it is essential that the photographer knows the market. It is pointless to approach a magazine, for example, without having first bought a copy and made an assessment of the types of work they publish. What is more, the selection of work a photographer takes to show people should always be geared to the particular publication or organization in question. Many professionals recommend that a new photographer should specialize early on so that his or her work has a clear direction and particular skills can be recognized. Once you are established you can then diversify more.

Make sure that your work is being shown to the right people. One way to sort out which art directors to visit for example, is to read the Advertiser and Agency List put out by a publication such as BRAD (British Rate and Date) which lists all the advertising agencies in Britain, naming their art directors and the accounts they hold. Similarly, if approaching a magazine, the names of the people you want to see are often listed on the masthead. The art editor is the person to see about editorial work, whereas fashion should usually be shown to the fashion editor. Always phone and make an appointment, and once you have shown your work, do not hang

Competitions *This picture was part of an exhibition of work Sally Fear was able to mount after winning an award*

Sally Fear

Photojournalist Sally Fear stresses the commitment and hard work that have been behind her decision to take up photography. She had been working as a secretary in London and New York for over 13 years when she started to become interested in photography. Working full time, she only had time to take pictures at the weekends. To her amazement, in 1975, she won a Nikon award which gave her the money and the camera to work on the idea she had submitted—'London at the Weekend'. She later spent a year at Magnum photographer David Hurn's course in Documentary Photography in Wales. As she had to keep working to support herself, she used her annual leave to attend college. In February 1978 she decided to go into photography full time. She now works on features for London's 'Observer' and 'Sunday Telegraph' and other publications.

W von dem Bussche/The Image Bank

Industrial photography *Many large industrial corporations have their own photographic units which carry out both technical and publicity work*

around. But do leave a card, and be prepared to come back with new work at a later date. Do not hassle for an assignment on the spot—work will rarely be given at a first encounter anyway.

You may be tempted to undercharge for your work in order to get a commission. While an unknown name cannot charge as much as an established photographer, it may be unwise to do this, as it could actually lose you work. People tend to think that if the fee is not high enough the work will not be very good. Undercharging is also considered to be unprofessional.

A professionally presented portfolio is vital. As a general rule, be selective—10 or 15 transparencies should be enough to give a clear idea of your work—and never include anything with technical faults, even if you think the content is brilliant. Your selection should have a clear direction so whoever is going to commission you will feel confident of your ability to meet a brief.

Black card mounts are a useful way of displaying both transparencies and prints. Any published work could be presented on a laminated board. Make sure everything is spotlessly clean and clearly labelled. Each transparency, for example, should say what the subject is, where it is and when the shot was taken. Each item should also show the photographer's name, address and telephone number. Stamps or printed labels can be ordered cheaply in bulk through advertisements in the trade press.

As well as actually taking work to publications and organizations, pictures can also be submitted to photographic agencies and libraries. This is an area which is open to the prolific amateur

Alan Duns/Marshall Cavendish

Bon appetit *Food photography requires high technical quality and attention to detail, and only a few photographers can work exclusively with food*

just as much as it is to professionals. A good picture library will act as a photographer's agent, selling work and chasing up fees. They take about a 50 per cent commission, which is fair bearing in mind that they can sell work which you probably could not and for a far higher fee. The first thing is to write or phone for their brochure which sets out their terms and the kind of work they carry. Addresses are listed in *The Creative Handbook* or *The Picture Researcher's Handbook*. Study the terms carefully as a signed contract will be required, often giving long-term access to your work. Again, all work submitted should be clearly captioned and bear the photographer's name and address. Model release forms are often required for close-up shots. Most agencies want colour material and are happy to accept 35 mm format.

Another way of airing work, usually more favoured by amateurs, though many professionals have had an early lucky break this way, is through entering competitions, or through having a portfolio published in a photographic magazine. Details of both avenues usually appear in the publications concerned.

Some amateurs attempt to break into press work by covering local events that the local newspaper cannot spare a photographer for. If your work is good they will probably use it, though payment per picture is usually very low—certainly not much more than the cost of a few black and white films. It is often only worth doing for the experience and the chance to add some published pictures to your portfolio.

Some amateurs take correspondence courses in photography. If these give you the opportunity to have your work criticised by an expert, they may be worth taking—though there are very few successful photographers around who began in this way.

Whatever avenue you choose, expect many disappointments. Persistence and charm are about as vital in photography as are perception and practical abilities!

Useful addresses

AUSTRALIA
Professional Photographers Association of Australia
3rd Floor, 129 York St
Sydney 2000

BRITAIN
Advertiser and Agency List
British Rate and Data
76 Oxford St, London W1

Association of Fashion Advertising and Editorial Photographers Ltd
10a Dryden St
London WC2

British Journal of Photography
28 Great James St
London WC1N 3HL

Institute of Incorporated Photographers
2 Amwell End
Ware
Herts SG12 9HN

National Council for the Training of Journalists
Harp House
179 High St
Epping
Essex CM16 4BG

The Photographers Gallery Ltd
8 Great Newport St
London WC2

CANADA
National Association for Photographic Art
10 Shaneen Blvd
Scarborough
Ontario M1R 1B5

Professional Photographers of Canada Inc
318 Royal Bank Bldg
Edmonton
Alberta T5J 1W8

NEW ZEALAND
New Zealand Professional Photographers Association Inc
National Secretary
Box 1590
Wellington

SOUTH AFRICA
South African Institute of Photographers
PO Box 52817
Saxonwold
Johannesburg 2132

U.S.
American Society of Magazine Photographers Inc
205 Lexington Av
New York NY 10016

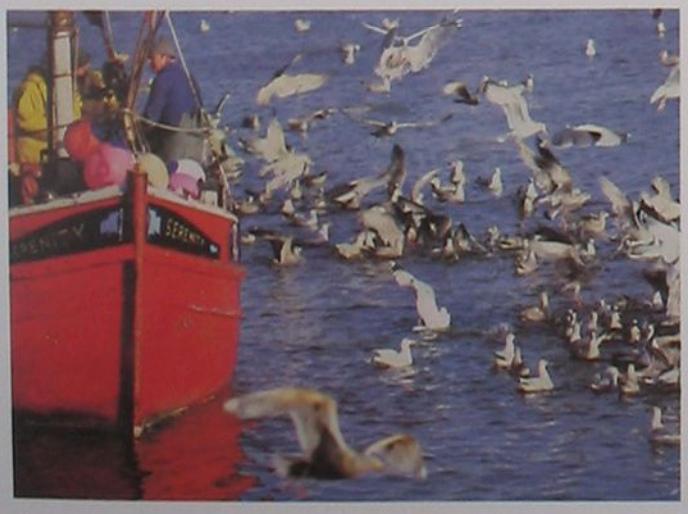
What went wrong?

Selecting the shot

Choosing the best shot from several good ones can be difficult. Ian McKinnell shows how he decided between four harbour pictures

All the photographs on this page were taken on the same day in a small fishing port. This was one of the first shots taken, an attempt to present an overall view of the harbour. It depicts an ungainly clutter of masts, a confusing scene in which it is difficult to see anything clearly. Too many small details vie for attention, to the detriment of them all, and the poorly framed foreground merely adds to the chaos by being almost unrecognizable. In addition, as it is taken into the light, the colours are reduced to a dull monochrome, the low contrast making details even more difficult to discern. In trying to show everything the shot shows very little.

Taken from the other end of the harbour, this picture avoids one of the problems of the first by shooting away from the sun, giving strong colour and contrast. Having moved in closer the elements are more clearly recognizable, although the background deteriorates into the clutter which marred the previous shot. While it is more attractive the composition is still 'obvious' and banal and because it concentrates on only one element —the superficial visual aspect of the boats—the image is lifeless and static, failing to reflect the activity that was an important point.



This photograph goes some way to redress the problems of the first shot, presenting further elements of the harbour—the fishermen stowing their equipment after a day at sea and the seagulls fighting for scraps of fish. It involves a better use of colour, the red boat creating strong contrast with the steel blue water. But the composition is clumsy, with an uncomfortably empty area in the centre, and does not show that the boat was in port—it could have been taken at sea on a calm day. The fishermen are too small in the picture and it is unclear what they are doing, with three of them hidden by the mast. It is the seagulls that receive prominence, and they were not the most important aspect of the port.

Superficially, this image may seem simpler than the other three, but actually it contains far more. There are; the fishermen at work, the seagulls, the boats suggested by the masts, ropes and pulleys, the calm waters and the harbour represented by the wall at the top of the picture which also creates a feeling of confinement. The fisherman, though small in the shot, is emphasized by both colour contrast and by selective focus. This narrow depth of field also helps to separate the gulls captured in flight from their out of focus companions resting in the distant background.